THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXX. No. 758.] LONDON, NOVEMBER 20, 1877. [29th Year.] Price 6d.

ESTABLISHED 1782.

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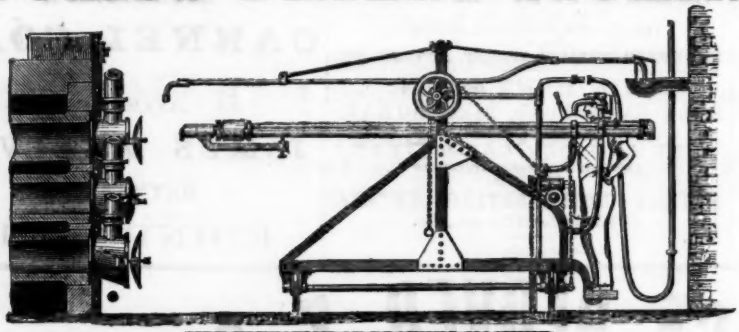
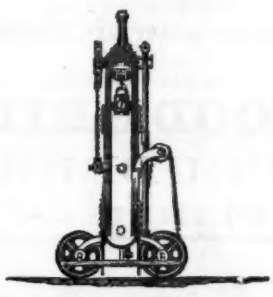


SIDE ELEVATION OF DRAWING MACHINE.



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The Silber Tubulated Gas-Burner.

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Also, he obtained a similar injunction against another defendant on the 9th of November, 1875.

Also, he obtained a similar injunction against another defendant on the 13th of January, 1876.

Also, he obtained a similar injunction against another defendant on the 16th of March, 1876.

Also, he obtained a similar injunction against another defendant on the 6th of April, 1876.

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The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

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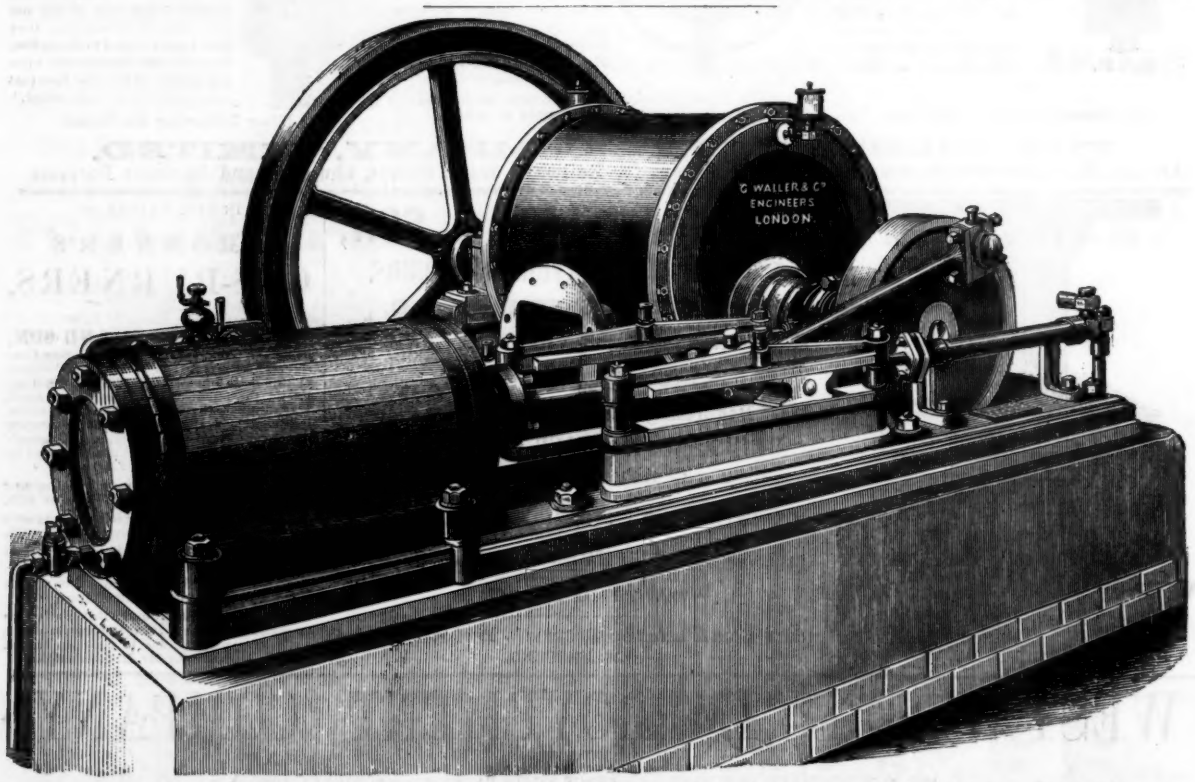

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This arrangement, specially designed and manufactured **solely by G. W. & Co.**, is suitable for Works making 10,000 cubic feet and upwards of gas per hour. The **Exhausters** are of **full capacity** for the quantity of gas to pass, have **wrought-iron spindles** to ensure perfect safety in working, the flanges of cylinders and edges of covers are turned, inlet and outlet flanges turned, faced, and drilled, and the base of each Exhauster is planed. The **Engines** have wrought-iron connecting-rods, with solid gun-metal ends, steel piston and slide rods, turned and polished discs, heavy fly-wheels turned on rim and edge and polished, cylinders are lagged with polished mahogany and brass bands, and the bed-plates are planed on the bottom surface. A heavy bracket and plummer block, with strong gun-metal bearings, support the shaft between the Exhauster and fly-wheel.

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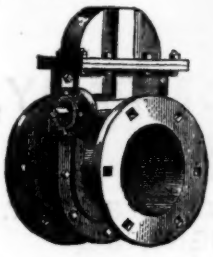

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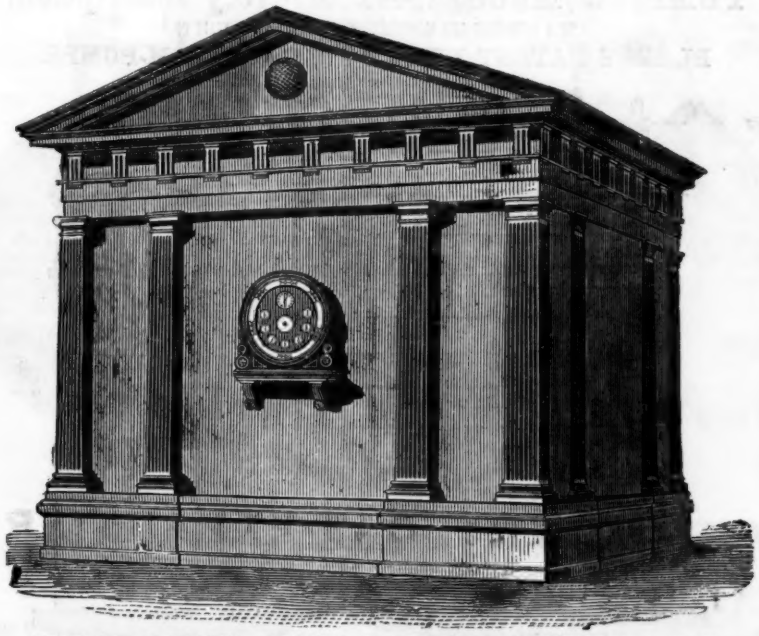

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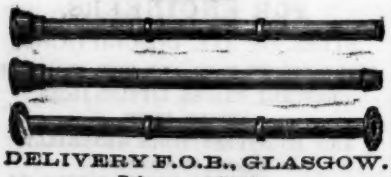
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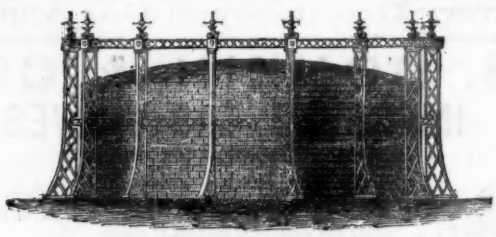
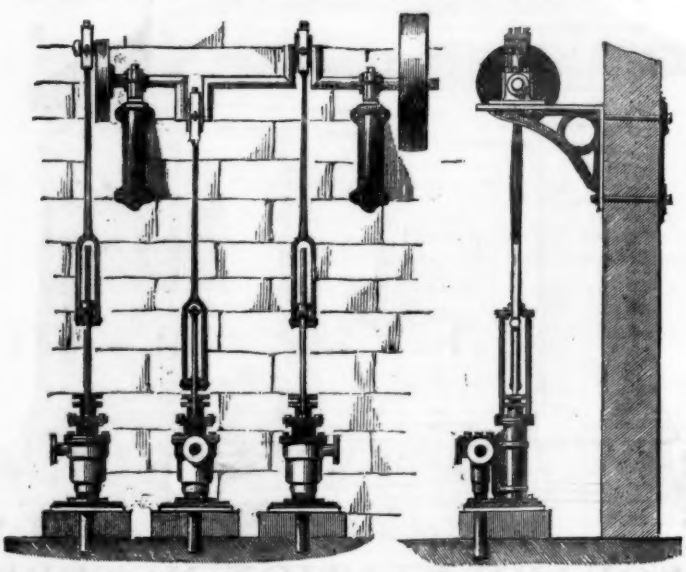
Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.



THE HORSELEY COMPANY,
LIMITED,
TIPTON, STAFFORDSHIRE.
LONDON OFFICE:
6, WESTMINSTER CHAMBERS, VICTORIA STREET,
GAS ENGINEERS, IRONFOUNDERS, &c.,
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,
WHITEFRIARS STREET, FLEET STREET, LONDON, E.C.,
Hydraulic Engineers,
AND MANUFACTURERS OF
PUMPING MACHINERY of every Description.
SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF
BLAKE'S PATENT DIRECT-ACTING STEAM-PUMPS.

IMPROVED DOUBLE-ACTION PUMPS.
For Water. For Tar. For Ammoniacal Liquor.
This illustration shows an arrangement of three (No. 179) Improved Double-Action Pumps driven from the same crank-shaft, as frequently supplied for use in Gas and Chemical Works. The suction and discharge pipes can be arranged for drawing from and delivering in any required direction.
These Pumps have been supplied to nearly all the large Gas Companies and Chemical Works, both for Pumping Water, Tar, and Ammoniacal Liquor.
GAS SYPHON PUMPS, IN COPPER OR SHEET IRON, ALWAYS IN STOCK.
Illustrated Catalogues sent post free on application.

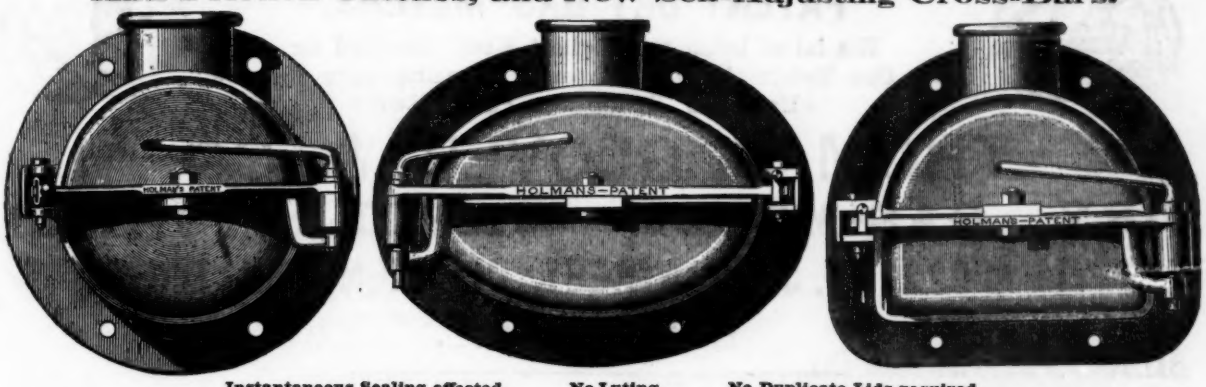
TANGYE BROTHERS AND HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON, E.C.

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), being now in use in nearly all the principal Gas-Works in London and the Provinces.

Messrs. T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT ITSELF (see Illustrations above), instead of, as heretofore, bringing the Mouthpiece from the D or Oval at back to Circular in front.

D and Oval Morton's Lids have now been working satisfactorily for the past two or three years, both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

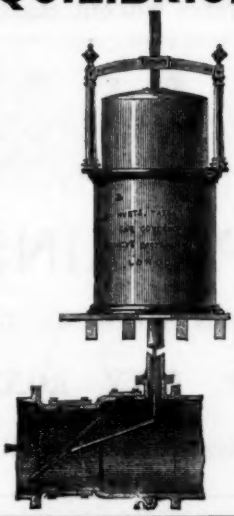
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

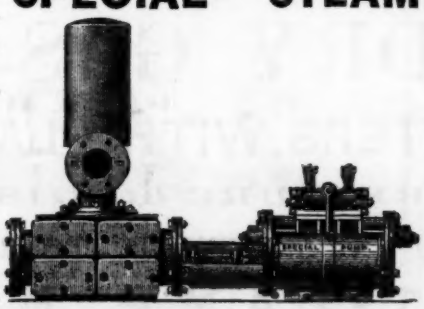
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851 New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

W. M.—*A consumer occupying premises which are partly in the district of one statutory company and partly in that of another can take gas from either for the supply of the whole.*

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 20, 1877.

Circular to Gas Companies.

THE great "Sulphur" Question came before Mr. Justice Fry last week, in the shape of a motion, made on the part of the Local Board of Health of West Ham, to obtain an injunction to restrain the Chartered Gas Company from committing a nuisance at their Bromley works. It will easily be understood that the nuisance complained of was alleged to arise from the escape of sulphuretted hydrogen when a lime purifier was changed. The evidence hardly supports this allegation, for the foul smell observed by the various witnesses, although intermittent, occurred at such irregular hours, that we cannot connect it with the changing of purifiers. As might be expected, we have the strange exaggerations of witnesses who, no doubt, desire to tell the exact truth, but, from circumstances, are led to make statements, the entire accuracy of which we can hardly think possible. Those who, like ourselves, have attended the opening of many a lime purifier, know well that the stink which is certainly emitted, lasts but a short time, and travels but a short distance. Supposing the lime to be afterwards used in making roads, the action of the atmosphere does not cause the continuous evolution of sulphuretted hydrogen, which a medical witness, with that strange ignorance of chemistry which medical men so continually exhibit, would have people believe. Every one conversant with the matter knows that sulphide of calcium, and also the less known sulphur compounds, are quickly oxidized on exposure to the air, without producing any smell whatever. It is somewhat amusing to read that a man, who must of necessity have his nose constantly exposed to stinks compared with which a little diluted sulphuretted hydrogen is a bouquet, is nauseated and made sick by a slight smell which had its origin a mile and a half away. We have in these columns frequently expressed an opinion that sulphuretted hydrogen, mixed with an enormous volume of air, would not travel that distance. This opinion is founded partly on theoretical grounds, but, as regards gas-works, we have our practical experience. In a laboratory, we know that the enclosed air strongly charged with sulphuretted hydrogen becomes sweet in the course of a few minutes. We shall not, of course, dispute the accuracy of testimony given on oath, while we wish to correct chemical errors. The nature of the most offensive compounds, the odour of which is most persistent and enduring, is, unfortunately, but little understood; but we know that even these bodies undergo rapid oxidation, resulting in the production of odourless compounds.

It is very odd that when inquiries are made as to the effects of unpleasant emanations from gas-works, they are not extended to an examination of the condition of the men employed on the works. We will not go the length of saying that the occupation of emptying a foul lime purifier is particularly healthy and pleasant, but we would submit that the operation of filling a purifier with fresh lime, especially if not well slaked, is equally unpleasant, and more dangerous to health. This matter, however, lies somewhat beyond the question with which Mr. Justice Fry had to deal, which concerned alleged nuisances outside the works. On this point we have popular prejudice against us, and popular prejudice is always more or less reflected in law courts. We cannot, of course, find fault with the decision of Mr. Justice Fry, but, as our readers will remark, the strangest confusion existed in the minds of advocates and judge. When an advocate has, perhaps at a few hours notice, to get up a case involving technical points, of which he had no previous knowledge, we cannot expect him to present a particularly intelligible statement to the judge; and when a judge is in the same state of mystification, we cannot expect a decision based on a profound knowledge of the real facts of the case. The day may come when a chemical judge will be called upon to decide chemical points; when an engineer will adjudicate on engineering questions; and, speaking generally, the time may arrive when disputes will be decided by those who have a perfect comprehension of them. It is our glorious boast, however, that no one doubts the integrity of an English judge, and, whatever his decision may be, it is always respected, unless reversed by a tribunal perhaps no better instructed, and much more mystified.

The decision of Mr. Justice Fry, it may be said, comes in confirmation of that of the Parliamentary Committee of last session. It is another expression of opinion that gas may be purified from "sulphur," and that the material used in the purification may be so disposed of as not to create a nuisance. Whether foul lime can be got rid of in such a way that stinks, far or near, may be prevented, is perhaps an open question. The matter which is forced upon our attention by this decision is one which has been frequently referred to in these columns. We have often remarked that foul lime need not necessarily produce a nuisance, but then comes the question whether lime, with the necessary employment of a purifier which must be repeatedly opened, is absolutely required for the removal of sulphur. The object of gas engineers and gas chemists, at the present day, and in view of our actual situation, should be to effect the complete purification of gas in closed vessels. The material is ready at hand, the effective employment of it has only to be devised. Surely this is not beyond the skill and talent of the engineers and managers we have in the metropolitan works of the present day. The Gas Companies will inevitably incur some expense in the replacement of plant, but peace and quiet should be secured at any cost, and consumers who insist on having gas free from sulphur must pay the unavoidable bill. Mr. Justice Fry has given the Chartered Company three months in which to make alterations. The interval is far too small, but will, no doubt, be extended upon application. In the absence of notices to the effect, we imagine that the Company do not intend to renew their application to Parliament to be relieved from the sulphur difficulty.

The report and recommendations of the Gas Committee of the Corporation of Birmingham, to which we referred last week, were only presented at a Council Meeting held on the 13th inst., when they were elaborated by Mr. Marris, as will be seen in

another column. His statement, which we present to-day, shows the Corporation in the past year lost by bad debts ·38 of a penny on every thousand feet of gas sold. This loss is excessive, and is not equalled by that of any Corporation or Company in the kingdom. The gas venture of the Corporation of Birmingham was made on purely philanthropic principles, but we early pointed out that the undertaking might not prove so remunerative as the enthusiastic promoters of the purchase hoped. The course the Gas Committee have now to pursue is perfectly clear. Without regard to the price of gas, about which we might say a good deal, they have to make their works remunerative, and in order to do so they must make their customers pay for the gas they consume. They may also, with perfect justice, charge a meter-rent, covering a reasonable per centage on cost and wear and tear. The idea of collecting small gas accounts fortnightly is simply absurd, and we are astonished that any business man, not a baker or a milkman, should have suggested it. The reading of a meter fortnightly would puzzle an experienced inspector, and a collector would want his commission quadrupled. The exaction of a deposit does not insinuate that a consumer is dishonest. No small tradesman will give credit except to a near neighbour, whose character he knows; but a Corporation or Gas Company have no near neighbours; they have a simple duty to perform to all their constituents, and that requires them to collect their gas accounts. We hope that Mr. Beard will not be long troubled about the price of coke. Trade will soon revive, and coke produce its full value.

Ideas are often twin-born. The letter of Mr. Aitken, which we publish in another column, shows that the value of desiccating gas had been discovered here contemporaneously with M. Brémond's experiments at Versailles. In experimenting with cannel gas, Mr. Aitken has not been annoyed with naphthaline; and, as he very truly says, thinking only of cannel gas, aqueous vapour does not very much matter, unless gas of over thirty-candle power is desired. Thirty-candle gas, however, as produced directly from cannel or shales, will soon be a thing of the past. Here, in the South, we have to put up with a very different quality, and Messrs. Aitken and Brémond have given some valuable hints to gas makers.

The Local Board of West Houghton have expressed a desire to purchase the undertaking of the West Houghton Gas Company, and have written to ask what terms will be required. Of course, these must depend upon the willingness of the Company to part with their property; but what may be called the parliamentary value of statutory Companies is now well determined, and the consideration for a purchase need hardly be asked. As the application has been made so late, we do not expect to hear of the purchase this year.

In reply to a deputation from the Improvement Commissioners at West Hartlepool, the Directors of the Gas and Water Company have refused to make a larger reduction than threepence per thousand feet, which brings the price of gas in their district to 3s. 6d. per thousand, subject to a discount according to the consumption. We confess that we have an objection to discounts, and would rather see an uniform price charged to consumers, small and large. Discounts do not increase consumption; for, as a Hartlepool Commissioner candidly remarked, consumers would not sit up all night to obtain the discount. When gas is consumed in a factory, and by its aid profits are earned, we think that a full and fair price should be paid. The Hartlepool Company are perfectly right in standing out for what they consider their due.

The idea of a purchase of the Liverpool United Gas Company by the Corporation is still entertained, and, for aught we know, may be eventually realized. The newly-constituted Town Council, with Mr. Forwood as Mayor, re-elected Dr. Cross as Chairman of the Gas Committee, and he promises that, in the course of the present municipal year, a Bill shall be deposited to effect the purchase of the undertaking of the Company. He has a difficult and anxious task before him, which will tax his energies to the utmost. We shall be grieved to see the Company —now, perhaps, the largest extra-Metropolitan—disappear; but the popular current cannot be stayed, and, on satisfactory terms, we fear that they must go.

The Farnworth and Kearsley Gas Company have, through their legal advisers, intimated to the Local Board that they are indisposed to part with their undertaking.

After existing together in peace for some years, the Local Board of Sheerness have once more fallen out with the Sheppy Gas Company. It is, of course, a question as to the cost of public lights. In strict compliance with the requirements of their Act, the Gas Company supply public lights at the lowest price charged to a consumer, *except under special contract*. That lowest price is 4s. 6d. per thousand; but there is a Dockyard at Sheerness. The Government, in the shape of a private consumer, have a special contract for the supply of gas at 3s. per thousand. The Local Board want public lamps supplied at the same rate, but the Gas Company, very properly, object. The gas supplied to the Dockyard is measured at the gates, and whatever loss, by leakage or otherwise, happens, the Gas Company do not suffer. It is otherwise with the supply to public lamps, which almost invariably entails a loss. There is the now common threat of substituting petroleum for gas, if the Company will not give in. We strongly recommend them to stand out. Let the Local Board make a trial of petroleum if they choose. After a year's experience they will be glad to beg for gas, and the Company may have their own terms.

An ingenious newspaper writer, who has probably never in his life been down in a mine, suggests the use of the electric light in illuminating underground workings. The idea is novel, and if light could only be persuaded to go round an infinite number of corners, it might be feasible. As the matter now stands, however, we are less hopeful of the illumination by electricity of mines than of model dwelling-houses.

INSTITUTION OF CIVIL ENGINEERS.—At the meeting of this society on the 13th inst., it was announced that Mr. Edward Small Cathels, of Montreal, and Mr. Alfred Penny, of Westminster, had, with others, been transferred by the council to the class of members.

WATER SUPPLY OF EXETER.—A special meeting of the Exeter Town Council was held on Friday last, at which it was resolved to promote a Bill in Parliament for the acquirement, by agreement or compulsion, of the works of the Exeter Water Company, or of any other company formed, or to be formed. A sub-committee were also appointed to confer with a committee of the water company, in reference to the offer made by the council for the purchase of their undertaking.

REDUCTIONS IN THE PRICE OF GAS.—The Gas Committee of the Corporation of Wigan have resolved that the price of gas shall be reduced 4d. per 1000 feet, both for the borough and country, on and after the 1st of January, 1878, and that the usual discount shall be allowed. The reduced prices will be as follows:—When the consumption is 150,000 cubic feet per annum, 3s. 6d., less 20 per cent. for cash, inside the borough, and 4s. 7d., less 20 per cent., outside the borough; when the consumption is less than 150,000 cubic feet per annum, the price within the borough will be 3s. 6d., less 10 per cent., and outside the borough 4s. 7d., less 10 per cent. The standard of illuminating power is 18 candles, tested by the old 15-hole Argand.

HULL GAS SUPPLY.—According to the report of Mr. James Baynes, the gas sent into the district of Sculcoates and Myton, during October, by the British Gas Company gave the following results, sulphuretted hydrogen and free ammonia being at no time present to the ordinary tests:—

	Max.		Min.		Mean.
Illuminating power standard sperm candles	16·36	..	15·62	..	15·95
Grains of sulphur per 100 cubic feet . . .	28·70	..	26·50	..	27·55

Mean barometer and temperature: bar., 30·08; temp., 57°. Mr. James Baynes, jun., reports the following as the results of his examination of the gas supplied to the East district by the Sutton, Southcoates, and Drypool Gas Company, during October:—

	Max.		Min.		Mean.
Illuminating power standard sperm candles	17·05	..	15·50	..	16·20
Grains of sulphur per 100 cubic feet . . .	—	..	—	..	7·25
Grains of ammonia per 100 cubic feet . .	—	..	—	..	19·20

Mean barometer and temperature: bar., 29·82; temp., 55·1°.

SALE OF PROVINCIAL GAS AND WATER SHARES.—At Sunderland, on the 14th inst., 509 original £5 shares in the Sunderland and South Shields Water Company were offered for sale by auction, and were speedily disposed of, at prices varying from £11 to £11 6s. per share; 309 new capital shares were as eagerly bought up at from £1 13s. to £1 15s. premium per share; and 89 original £5 shares in the Sunderland Gas Company sold at from £10 11s. to £10 12s. per share, and 50 additional capital £5 shares for £8 6s. each. On Friday last 250 fully paid-up £5 B shares in the Wakefield Gas Company were sold in lots by auction at Wakefield, and realized prices varying from £8 10s. to £8 13s. 6d. each, the total amounting to £2158 13s. At the same time six original fully paid-up £5 shares in the Ossett Gas Company were put up for sale, but were withdrawn at £2 12s. 6d. each; and six fully paid-up £5 shares in the Mirfield Gas Company were sold, realizing £11 7s. 6d. each.

PROPOSED PURCHASE OF THE STOKE AND FENTON GAS-WORKS.—The terms agreed upon by the joint committees of the Fenton Local Board and the Town Council of Stoke relative to the purchase of the undertaking and property of the Stoke and Fenton Gas Company are as follows:—"1. The respective governing authorities shall jointly purchase the gas-works and other property of the gas company, finding equal shares of the required capital. 2. The first charge upon the income in every year shall be the annual payment of the interest and instalment on the purchase-money. 3. The remaining profits shall be applied to the benefit or credit of the separate authorities year by year, in the proportion of the consumption during each period within the area of each district. 4. The management of the undertaking shall be in a board or committee nominated in equal proportions by each authority as they shall respectively determine."

THE METROPOLITAN BOARD OF WORKS AND THE PREVENTION OF FLOODS IN THE THAMES.—At the meeting of the Board, on Friday last, Mr. Fowler moved, pursuant to notice—"That the application made by the Board to Parliament last session for power to take measures for the prevention of the overflow of the Thames, within the metropolitan area, not having been attended with success, the Board is of opinion that some action should be taken during the next session to obtain power to deal satisfactorily with the question, and that the matter be referred to the Works and General Purposes Committee for consideration and report." Mr. Munro seconded the motion, to which, however, Mr. Richardson moved the following amendment:—"To leave out all after the word 'taken,' and instead thereof to insert—'To ascertain the opinion of the High Court of Justice as to the duty of vestries and district boards, under the 69th and 70th sections of the Metropolis Local Management Act, to take measures for the prevention of such overflow within their respective districts, and that the solicitor be instructed to take such proceedings for this purpose as he may be advised.'" After a considerable amount of talk the amendment was negatived by a majority of 17 to 13. The original motion was put, and on a division being called for, there appeared—for the motion, 11; against it, 20; so that both motion and amendment were negatived.

Water and Sanitary Notes.

THE members of the Metropolitan Board of Works are forty-six in number. Last Wednesday a special meeting was called to consider the most important question ever brought before the Board—important in a double sense, having regard to the vast outlay proposed, and the sanitary interests of our population. Thirty members met, and, by a majority of four, which included a vote given by the Chairman as an individual member, resolved on promoting two measures, which, if successful, would add, at least, thirty millions to the debt of the Metropolis. But they will not be successful. The only result of their promotion, unless it should be contrived that they fall through for non-compliance with Standing Orders, will be a large addition to the outlay of the Board for parliamentary expenses. Respecting the debate, which we report in another place, we need only say that it was worthy of the Metropolitan Board. The report is the best we can give; for the debate was carried on, as usual, amid a buzz of general conversation, which, at times, made it difficult to catch the exact words of the speakers. A good many members rose *on* the occasion, but we cannot say they rose *to* the occasion. Few who spoke—and we write quite impartially—could have given that consideration to the question which its momentous importance deserved. We listened in vain for speeches such as are heard in the Town Councils of Birmingham, Manchester, and Liverpool, and wondered, when we reflected that the Board are supposed to represent a population of three and a half millions, among which are numbered the most able and intelligent men in the country. And yet there is no cause for wonder. While the Metropolitan Parliament consists of vestry delegates, we can expect nothing better.

It will be seen that no substantial reason was urged in support of the step the Board have now resolved to take. There was the time-worn cant which asserts that the supply of the necessaries of life should not be conducted upon commercial principles; there were the usual allegations respecting the bad quality of the water supplied by the Companies, and the usual boast that the Board can raise money at three and a half per cent. There were also, of course, the usual complaints, altogether unsubstantiated, of the insufficient supply of water for the extinguishing of fires. On this latter point, we notice the great hesitation of the Board in supporting the new scheme. A simple proposal to buy up the Companies would probably have met with almost unanimous support, but it is quite clear that the new scheme finds but small favour. Members stand a little aghast at the idea of ripping up both sides of every street in the Metropolis, and boring into every house, to kindly furnish a small closed receptacle for "potable" water; and really the proposal is absurd. If ever introduced to a parliamentary committee, we feel confident it would be laughed at. The Board, we believe, will be met by the Water Companies in a compact phalanx. It is said that the policy we have so often urged upon the Companies is about to be pursued; that a combination will be effected, and such additions to existing works will be made as will do all and more than is proposed by the Metropolitan Board.

The Corporation of London do not seem to be at one with the Metropolitan Board on this question. Gog and Magog, though occasionally stirred into lively activity, as recently on the sulphur question, generally lag behind and wait upon events. They may safely do so now; it will take several years to settle this water question, which, perhaps, will never be seriously considered until the municipal system of the entire Metropolis is revised. But there is no knowing. The erection of Tenterden Steeple brought Goodwin Sands; and who can say what will follow the removal of Temple Bar?

A majority in the Metropolitan Board of Works are most unaccountably averse to charging the whole Metropolis with the expenditure of a few thousand pounds, for the protection of a large number of poor people from the effects of the overflows of the Thames. Last year they found themselves face to face with a Committee of the House of Commons, who, in our opinion, rightly decided that the costs should be levied on the whole metropolitan area. It is true that some large waterside proprietors are concerned in the matter, but if they raise the banks of the river to protect their own premises, the simple result would be increased disaster to their poor neighbours, for whose protection they are not individually responsible. The work required will presently have to be done, and the Metropolitan Board of Works may as well do it at once with a good grace. Perhaps they may think it worth their while to reconsider the decision which was arrived at last Friday.

Kirby Moorside is supplied by a Company with water which is of a highly satisfactory quality, but which is at present not perhaps furnished in sufficient quantity. We understand the Local Board of Health desire to make up for the insufficiency by works of their own, and for this purpose they applied to the Local Government Board for permission to borrow £3000. At a local inquiry held by Mr. Harrison, as an Inspector for the Local Government Board, he expressed an opinion that "the "Gas and Water Company appeared to be a *bonâ fide* Company "for the benefit of the town rather than a financial Company "for the purpose of profit, and he should recommend that the "Sanitary Authority should treat with the Company to bring "an independent supply from Harland Spring, on similar terms "to those suggested—viz., that the Sanitary Authority guarantee "the Water Company twopence per week for every house in the "town for domestic purposes, and all houses above £5 rent to "be charged a larger sum according to their increased require-"ments."

At a meeting of the shareholders of the Leicester Water-Works Company, the agreement for the sale of the undertaking to the Corporation was confirmed. In responding to a vote of thanks, the Chairman dropped a few wise words of caution. He recommended the Corporation to husband their water resources, or a large further expenditure of capital might soon be necessary. The advice was proper, but hardly required. The Corporation will soon put the screw on the taps, and the consumption of water will be greatly reduced.

The Corporation of Newport (Isle of Wight) are bent on reducing the waste of water within their limits. It has been ascertained that some 80,000 gallons of water escape within the nine hours of every night. The reason for this is perfectly obvious, and the Corporation must exert all the powers they possess to compel their customers to have proper fittings. They have an able Engineer—Mr. Minns—who may take counsel with Mr. Deacon, and settle exactly where the waste occurs.

We are happy to see that Mr. J. H. Wilson has been re-elected Chairman of the Water Committee of Liverpool. His large experience of the question of water supply, and his great business capacity, render, we may say, his services essential to the Corporation. In the discussions which will soon take place in the ensuing year, respecting the source of a new supply, his assistance and advice will be of the utmost importance.

The supply of water to Sheerness is in the hands of the Local Board. They expended on this service last year £1800, and they received £1200, which, of course, left them £600 to the bad, which sum must be made good somehow or other. It is clear that the possession of the water undertaking by the Local Authority will not diminish the rates in Sheerness.

The Town Commissioners of Weston-super-Mare have decided on purchasing the water undertaking for the sum of £65,000, which is to be paid off by means of a sinking-fund, or otherwise, within a period of sixty years. It is proposed that the sinking-fund shall not be commenced until the expiration of seven years after the passing of the Act which the Commissioners hope to obtain. Till then the Company are to receive £2600 annually as interest on the purchase-money.

RENDERING PORTLAND CEMENT CONCRETE WATER-TIGHT.—With reference to the discussion in recent issues of the JOURNAL on the question of Portland Cement Concrete, our Glasgow correspondent quotes the experience gained by the practice at the Rothesay Aquarium. He says: "Concrete tanks can be made practically water-tight by first using a good stiffish body of concrete, just composed of such proportions as should be used in order to make a good job, judging by the quality of the cement. Use clean sand, thoroughly free from soil, and then give a coat, one inch in thickness, of *pure* cement, finished and *polished* as hard as possible. By adopting such a course of procedure the tank is practically water-tight. This is what was done in the large reservoir-tank at the Rothesay Aquarium, and it succeeded famously, whereas under the ordinary method it leaked like a basket."

GAS EXPLOSIONS.—Just before midnight on Wednesday last an explosion of gas occurred at 130, Barkerend Road, Bradford. One side of the house was blown down, and windows were broken in the houses opposite. The house had been closed for some days in consequence of the absence of the family. It is supposed that the house was filled with gas from a leakage in the main-pipes in the adjoining street, and that on Mr. Collinson, the occupier, striking a light the explosion occurred. Mr. Collinson was severely burnt, and was removed to the infirmary.—On Friday, about midday, an explosion occurred at the rear of some premises in North John Street, Liverpool. It appears that at the time some workmen were engaged in making a connection between the main gas-pipe and pipes being attached to the building, when, somehow, gas was allowed to generate in the basement and also to leak from the main. In the cellar there was a light, and the gas coming into contact with this there was an explosion. The damage done was not great, but one man was slightly injured.—At Higher Broughton, Manchester, on Wednesday, Mr. Gregory, a provision dealer, on coming downstairs perceived a smell of gas in one of the rooms, and proceeded with a lighted candle to find out where the escape was. In passing the light along the gas-pipe near the ceiling, the accumulated gas took fire and a loud explosion occurred, smashing every window in the house, even breaking open the shop shutters and shattering a window on the opposite side of the street. Considerable damage was done to the furniture, and the curtains and blinds were set on fire, and the force of the explosion was such that the wall at the bottom of the stairs was shifted several inches from its place. Mr. Gregory himself was seriously burnt about the head, face, and neck. The damage is estimated at from £50 to £100.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CL.

TABLES OF THE DISCHARGE OF GAS IN CUBIC FEET PER HOUR, THROUGH PIPES OF VARIOUS DIAMETERS AND LENGTHS, AT DIFFERENT PRESSURES (*continued*).

By THOMAS G. BARLOW. Extended by THOS. NEWBIGGING.

(The specific gravity of the gas is taken at ·4, air being 1.)

Diameter of Pipe, 10 *Inches.*

Length in Yards	500.	750.	1000.	1250.	1500.	1750.	2000.
Quantity delivered with 0·1 inch pressure	9,560	7,800	6,750	6,050	5,520	5,100	4,780
" " 0·2 "	13,500	11,040	9,560	8,520	7,800	7,300	6,750
" " 0·3 "	16,500	13,500	11,700	10,520	9,560	8,850	8,250
" " 0·4 "	19,120	15,600	13,500	12,100	11,040	10,200	9,560
" " 0·5 "	21,300	17,400	15,050	13,500	12,380	11,400	10,650
" " 0·6 "	23,355	19,120	16,500	14,800	13,500	12,500	11,650
" " 0·8 "	27,000	22,005	19,120	17,050	15,600	14,400	13,500
" " 1·0 "	30,105	24,570	21,330	19,120	17,400	16,150	15,050
" " 1·2 "	32,940	27,000	23,355	20,911	19,035	17,550	16,578
" " 1·5 "	36,855	30,105	26,055	23,355	21,300	19,600	18,500
" " 1·8 "	40,500	32,940	28,620	25,515	23,355	21,600	20,250
" " 2·0 "	42,660	34,830	30,105	27,000	24,570	22,800	21,300
" " 2·5 "	47,655	38,880	33,750	30,105	27,540	25,501	23,760

Diameter of Pipe, 12 *Inches.*

Length in Yards	500.	750.	1000.	1250.	1500.	1750.	2000.
Quantity delivered with 0·1 inch pressure	15,100	12,300	10,700	9,550	8,700	8,050	7,550
" " 0·2 "	21,400	17,400	15,100	13,450	12,300	11,350	10,700
" " 0·3 "	26,100	21,400	19,500	16,500	15,100	13,880	13,050
" " 0·4 "	30,200	24,600	21,400	19,100	17,400	16,100	15,100
" " 0·5 "	33,600	27,500	23,800	21,400	19,440	18,050	16,800
" " 0·6 "	36,741	30,200	26,100	23,300	21,400	19,800	19,500
" " 0·8 "	42,573	34,603	30,200	26,900	24,600	22,700	21,400
" " 1·0 "	47,433	38,880	33,631	30,200	27,500	25,450	23,800
" " 1·2 "	52,099	42,573	36,741	32,853	30,112	27,799	26,049
" " 1·5 "	58,320	47,433	41,212	36,741	33,600	31,250	29,250
" " 1·8 "	63,763	52,099	45,100	40,396	36,741	34,020	31,881
" " 2·0 "	67,262	54,820	47,433	42,573	38,880	36,100	33,600
" " 2·5 "	75,232	61,430	53,071	47,433	43,351	40,240	37,519

Diameter of Pipe, 14 *Inches.*

Length in Yards	500.	750.	1000.	1250.	1500.	1750.	2000.
Quantity delivered with 0·1 inch pressure	22,100	18,100	15,600	13,950	12,750	11,800	11,050
" " 0·2 "	31,200	25,500	22,100	19,800	18,100	16,700	15,600
" " 0·3 "	38,400	31,200	27,100	24,250	22,100	20,500	19,200
" " 0·4 "	44,200	36,200	31,200	27,900	25,500	23,600	22,100
" " 0·5 "	49,400	40,400	35,000	31,200	28,500	26,460	24,700
" " 0·6 "	54,216	44,200	38,400	34,300	31,200	28,900	27,100
" " 0·8 "	62,445	51,067	44,200	39,600	36,200	33,400	31,200
" " 1·0 "	69,854	57,153	49,480	44,200	40,400	37,300	35,000
" " 1·2 "	76,681	62,445	54,216	48,421	44,188	40,986	38,340
" " 1·5 "	85,730	69,854	60,593	54,216	49,400	45,700	42,600
" " 1·8 "	93,906	76,681	66,414	59,270	54,216	50,009	46,834
" " 2·0 "	98,960	80,703	69,854	62,445	57,153	52,920	49,400
" " 2·5 "	110,602	90,228	78,268	69,854	63,768	59,005	55,301

Diameter of Pipe, 15 *Inches.*

Length in Yards	500.	750.	1000.	1250.	1500.	1750.	2000.
Quantity delivered with 0·1 inch pressure	26,300	21,400	18,600	16,600	15,200	14,000	13,150
" " 0·2 "	37,200	30,400	26,300	23,500	21,400	19,900	18,600
" " 0·3 "	45,500	37,200	32,250	28,750	26,300	24,300	22,750
" " 0·4 "	52,600	42,800	37,200	33,200	30,400	28,000	26,300
" " 0·5 "	58,700	48,000	41,600	37,200	34,000	31,400	29,350
" " 0·6 "	64,395	52,600	45,500	40,700	37,200	34,450	32,250
" " 0·8 "	74,115	60,750	52,600	47,000	42,800	39,800	37,200
" " 1·0 "	82,923	67,736	58,623	52,600	48,000	44,400	41,600
" " 1·2 "	91,125	74,115	64,395	57,408	52,548	48,600	45,562
" " 1·5 "	101,756	82,923	71,988	64,395	58,700	54,300	50,800
" " 1·8 "	111,476	91,125	78,914	70,470	64,395	59,535	55,586
" " 2·0 "	117,551	95,985	82,923	74,115	67,736	62,800	58,700
" " 2·5 "	131,523	107,223	92,947	82,923	75,937	70,166	65,610

Diameter of Pipe, 16 *Inches.*

Length in Yards	500.	750.	1000.	1250.	1500.	1750.	2000.
Quantity delivered with 0·1 inch pressure	31,000	25,250	21,850	19,550	17,850	16,550	15,500
" " 0·2 "	43,700	35,700	31,000	27,700	25,250	23,400	21,850
" " 0·3 "	53,600	43,700	38,100	34,000	31,000	28,700	26 800
" " 0·4 "	62,000	50,500	43,700	39,100	35,700	33,100	31,000
" " 0·5 "	69,120	56,600	49,000	43,700	39,900	37,150	34,560
" " 0·6 "	75,686	62,000	53,600	47,900	43,700	38,100	40,700
" " 0·8 "	87,402	71,193	62,000	55,400	50,500	46,800	43,700
" " 1·0 "	97,459	79,488	69,120	62,000	56,600	52,400	49,000
" " 1·2 "	107,066	87,402	75,686	67,703	61,516	57,024	53,533
" " 1·5 "	119,577	97,459	84,326	75,686	69,120	63,900	60,100
" " 1·8 "	130,982	107,066	92,620	82,944	75,686	70,087	65,318
" " 2·0 "	138,240	112,665	97,459	87,402	79,488	74,300	69,120
" " 2·5 "	154,483	126,144	109,209	97,459	89,164	82,598	77,068

(*To be continued.*)

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

SYMES'S PROCESS FOR MANUFACTURING GAS.

SIR,—I should like to offer a few observations upon this process as described and illustrated in the last number of your JOURNAL.

An inventor once said that it is unfair to pretend to judge of the merits of an invention by merely reading the specification of the patent, because everybody knows that before an invention could be got into operation so many changes have to be made that the workable and the specified apparatus are not known one by the other. This may be the opinion of "everybody," but the law does not recognize such changes, unless covered by subsequent patents. Taking it for granted, therefore, that the legal view is the correct one, I shall not expect to be judged as unfair if I give an idea of the workableness of the apparatus illustrated in your last issue.

I shall, of course, suppose the apparatus spread out as it would be in practice, and not as shown. The reason for arranging the different parts as illustrated is manifestly for the sake of the compactness required for experimental apparatus. I have, therefore, nothing to do with position, but rather with the suitableness of the parts, when arranged according to circumstances, to accomplish what is claimed for them.

Now, to begin at the beginning, I will take the retorts, and imagine a number of them set in a range, so that the discharging mouthpieces and hand-gear for operating the "doors" or throttle-valves that separate the vertical portion of the retorts from the bent portions, or discharging ends, are all on one side, whilst the furnaces for heating them are on the other. So far we have the range complete. Then follows the hydraulic main, which, in this case, accords with its name, for no tar is to enter therein. It is not placed, therefore, after the usual manner, near and over the retorts, but at a distance, the connecting-pipe from each retort taking a slightly inclined position. The reason for this I presume is to assist that peculiar cluster of perforated plates fixed to the interior surface of the upper lid of each retort, the object of which, we are told, is to return the tar again to the retort, to be "burned or regenerated"—*i.e.*, made into soot or revaporized, and so on. This soot or lampblack will severely try the functions of the cup-shaped spindle valve, placed in an inverted position over the end of the connecting-pipe, which, in this case, enters the hydraulic main through the bottom instead of the top. The cup of this valve dips into the *water* contained in the main, and opens upwards to allow the gas to enter, but closes—that is, dips into the water—to prevent its return. "It also prevents the entering in of all impurities, except a small quantity of sulphur, which is removed by the purifier." But what becomes of the other impurities that cannot enter the hydraulic main because of the said cup-valve? Where is the comparatively large quantity of sulphur and ammonia, as well as carbonic acid? Have they, because the retorts are set vertically, fallen to the bottom and become lost, or is there some provision for their capture that we do not read of? Notwithstanding that no impurities are allowed to enter the hydraulic main, its interior has a certain maze-like construction, with *chevaux de frise* bristling therein for arresting "sulphurous vapour," so the little that we suppose might have escaped the vigilance of the "cup-valve" is still liable to be spiked.

This is the first time that we have read of so much being done with regard to the purifying of gas by mechanical means only. Purifiers are mentioned; but as there would appear to be nothing for them to do, except to stand by just to catch any sulphur compound that might chance to escape the destruction awaiting it in the hydraulic main, I need not further allude to them.

I shall, for the sake of noticing another mechanical speciality, take one retort as about to be charged for the first time. The discharge-lid on the end of the bent portion of the retort is, of course, on, and the "door" that turns on a spindle closed, to prevent the coal, when introduced, falling into that portion of the retort that is reserved as a chamber for the coke of one charge whilst another is being inserted.

The upper lid having been removed, the charge of coal is dropped in and rests on the revolving "door." This lid being replaced, I will suppose that the process of carbonization goes on according to the new theory as regards impurities and other matters. I also take it that the heat of the retort is all right, therefore the charge from the "door" upwards, after a certain time, will be fully carbonized, consequently, there will then be resting on the revolving "door" a column of coke at a carbonizing temperature. That being so, I do not see why the door, and the spindle on which it turns, should be less hot. The time having arrived for drawing the spent charge and introducing another, the "door" at the foot of the said charge has to be turned from the horizontal to the vertical, in order to allow of the coke falling from the carbonizing part into the chamber below. The door is again placed horizontally, and a fresh charge of coal introduced. This is the specified routine. Now I am inclined to think that such a contrivance cannot work. I do not see how the door can, in its soft condition caused by heat, be made to *crush* its way through the coke resting on it, and I am quite sure that it would not be gas-tight during the time of drawing the coke from the lower chamber, the fresh-charge being in the upper one, and gas being evolved.

I may be told that this is not the way the promoters of the "Pure Carbon Gas Company" intend carrying out their scheme. Very well, if that be the case, all I can say is that I have taken some trouble to review a sham.

Nov. 17, 1877. W. M. G.

NAPHTHALINE.

SIR,—Under reference to M. Brémond's letter, which appeared in your issue of the 6th inst., it appears to me that M. Brémond attempts to narrow the claims of my patent—No. 2587, 1874—farther than the facts will warrant. In that specification I state (*inter alia*):

"I have further found that the presence of aqueous vapour in gases prevents them from absorbing and from retaining hydrocarbon vapours, and that the gases, in the presence of aqueous vapour, deposit much of their light-giving constituents.

"I have also found that by depriving gases of aqueous vapour in the manner hereinafter described, they have the power of retaining and absorbing hydrocarbon vapours to a greater extent, and so increasing the illuminating power of the gases beyond what is obtained under the existing practice.

"Another part of my said invention relates to a treatment whereby gases are enabled to retain permanently hydrocarbon vapours suspended therein. To effect this I remove the aqueous vapours from the gases by causing them to pass over or through dry caustic lime, or other absorbent of aqueous vapour. These absorbents are placed in a chamber on trays or pipes, or otherwise arranged so as to expose a large absorbing surface to the gases, which are thus treated after they leave the last purifiers; or these gases so dried may be further enriched by passing them over or through tars or oils rich in volatile hydrocarbons, heated to a temperature of about 190° Fahr.

"To prevent the gases during their subsequent storeage and distribution from re-absorbing aqueous vapours, I cover the surface of the water in the tank containing the gasholder with a layer or film of tar or oil saturated with paraffin or other like spirit; but I prefer to use commercial 'intermediate paraffin oil' saturated with paraffin spirit or other light spirit, so as to prevent the water from absorbing hydrocarbons from the gases.

"The saturated oil or tar, or preferably 'intermediate paraffin oil,' may also be used with advantage in wet meters, as, besides being a non-absorbent of hydrocarbon vapours, it is not subject to evaporation at ordinary temperatures, and thus a constant liquid level is obtained, and correct measurement of consumption effected."

I think the above will show you that not only was I aware, in 1874, that aqueous vapours were injurious to the illuminating power of gas, but also that their presence prevented the gas from retaining hydrocarbons; and, further, that I devised means whereby to get rid of the aqueous vapours, and so prevent their injurious action, thus anticipating M. Brémond's invention.

I have only to add that, in conducting the process of gas manufacture under my patent, it is not *necessary* to desiccate the gases unless it is desired to make a gas above 30-candles illuminating power; as, up to this point, the presence of aqueous vapour does not, in condensing, materially reduce the amount of benzole in the gas, unless the temperature is very low. No doubt there is a direct increase of illuminating power from desiccated gases; but I will not enlarge farther on this, as I hope shortly to place before the West of Scotland Association of Gas Managers a paper upon the influence of aqueous vapours on illuminating gases.

Darroch, near Falkirk, Nov. 12, 1877. HENRY AITKEN.

MAIN-LAYING UNDER WATER.

SIR,—Would you kindly allow me to put, through your valuable JOURNAL, a few questions to any of your correspondents, as to laying gas-mains under water?

1. The depth and width of the river in which any pipes may have been laid?

2. The size of pipes and kind of joint, whether spigot and socket or flange; and if flange, whether planed; also the material used between the joints?

3. The method and means by which they are laid, whether by damming the river or otherwise?

4. Whether the pressure is much affected, and to what extent; also the difference of condensation, if any, between mains laid under water and those in the ground?

Nov. 14, 1877. E. P.

THE REVIVIFICATION OF FOUL LIME.

SIR,—The information contained in your issue of the 6th inst., concerning the attempt being made at Paisley to revivify foul lime, renders it possible to discuss the applicability of this method of revivifying by reburning, at least as far as London is concerned. This method of burning fouled lime in the flare of a furnace is by no means new; but until last week no figures, I believe, had been published that would enable one to form an idea as to cost. Now, 8s. 6d. per ton would not be cheap for a lime containing perhaps 20 per cent. of sulphate, when we take into consideration that the purifiers would have to be emptied and recharged more frequently, and that labour would be a larger item.

In your article dated Oct. 23, you anticipate the production of sulphate when lime is reburned in the ordinary method. This would infallibly occur if there were sufficient oxygen present to convert the sulphide into sulphate; besides, experience points to this conclusion. However, I think I can indicate how this difficulty could be met without the use of a current of hot steam. It would be easy to burn the lime in such a manner as to leave the sulphur combined as sulphide, and not as sulphate, which, once formed, is not to be easily got rid of, and is of no use for purifying purposes. By treating the calcined material immediately after being raked out of the calcining chamber, whilst still hot, with hot water thrown on with a pail, or by any other simple means, one-half the sulphide is converted into hydrate of lime, and one-half into sulphydrate, according to the reaction shown in my last letter. In works where oxide is used, this small proportion of sulphydrate is of no moment; for carbonic acid will combine just as readily with the lime of the sulphydrate as with the lime of the hydrate. The only objection to the presence of the sulphydrate is the diminished efficiency with regard to the sulphuretted hydrogen, which deficiency would not be felt where oxide is used for removing the greater proportion of the sulphuretted hydrogen.

Of course, by far the larger part of the lime used in the most modern processes of purification is neutralized by carbonic acid, as a consideration of the following formulæ and figures will show:—

$$CaO, H_2O + CO_2 = CaOCO_2 + H_2O.$$
$$CaS, H_2S + 2H_2S = CaS, H_2S + 2H_2O.$$

The lime combines with carbonic acid in the proportion of 56 to 44; with sulphuretted hydrogen in the proportion of 56 to 66. These two impurities exist in gas, as ordinarily presented to the purifiers (after efficient scrubbing), in about the following quantities, calculated to purified gas:—Carbonic acid, 1·57 per cent. of volume, 12·7 grains per cubic foot by weight; sulphuretted hydrogen, 1·37 per cent. of volume, 8·7 grains per cubic foot by weight. Assuming these quantities to be true for the majority of cases, there will, in theory, be required of lime

(CaO) 1·08 lb. for the sulphuretted hydrogen, and 2·31 lbs. for the carbonic acid.

In cases where no oxide is used, these figures will well represent the respective proportions of lime used for the extraction of these two impurities—viz., 32 per cent. of the lime for sulphuretted hydrogen, and 68 per cent. for the carbonic acid.

In certain processes where the sulphydrate and the carbonate are to some extent distinct, doubtless two different processes of revivification would be required. The process described in my previous letter would meet the former case, with the production of bisulphide of carbon; and the process now described would be useful for the latter case, if the production of sulphate be apprehended and its avoidance desired.

Before closing this letter, permit me to point out a material nearly analogous to gas lime—the waste from the alkali-works. This, according to the text-books, is sulphide of calcium (CaS); but after being exposed to the action of water and air, it has, with some minor exceptions, such as sulphocyanides, &c., an almost identical composition to the gas-works refuse that has been exposed. When in the North of England lately, amongst the chemical works, I was informed that there was then no practical process for the revivification of this waste, and that it was removed at great expense, in most cases being shot into the sea. The history of this material and that from the gas-works tells us that the question is one most difficult of solution, but whether a more profound knowledge of the chemistry of these materials will lead to complete success is a tale to be told in the future—the age of (to quote your own words) "the most perfect utilization of residuals." Whether the time will come when gas companies will have the same interest in the removal of bisulphide of carbon from the gas, as they now have with ammonia, I know not; but that it is an idea neither Utopian nor chimerical I think I have shown. In the meanwhile, we must await events.

LEWIS T. WRIGHT.

23, *Sutherland Gardens, W., Nov.* 8, 1877.

IRON PEROXIDE.

SIR,—I am obliged to Mr. W. Cleland for his letter, respecting ground hematite, in your last week's issue. I do not question his statement as to its being useless for gas purification, notwithstanding that laboratory experiments of mine point to an opposite conclusion; but I altogether take exception to the reason he assigns for its failure, even if hematite were always anhydrous, which it is far from being; the numerous varieties of brown hematite (limonite) being all hydrated.

The next time a correspondent undertakes to correct the phraseology of others in chemical matters, allow me to suggest the desirability of some modern manual of chemistry being consulted. In this instance it would be found that the term sesquioxide, which Mr. Cleland says is more precise, is now obsolete, and that the word peroxide, which I used, is the scientifically correct one.

A GAS DIRECTOR.

CONSULTING ENGINEERS CHARGES.

SIR,—The Gas Committee under whom I am at present employed as engineer and manager, previous to my appointment, called in a consulting engineer to prepare plans and specifications of a telescopic gasholder and tank, and obtained tenders for the work; but when the tenders were opened the price was so heavy (partly on account of the high price of materials then, and partly from the extravagant manner in which the work was set out) that the Gas Committee thought it wisdom to defer the work.

We have lately commenced to erect a telescopic gasholder and tank, but not at all copied from the consulting engineer's plan, which was for a three-lift gasholder, and the one we are erecting is a two-lift holder.

I shall accept it as a great favour if some reader will inform me what it is the custom to pay consulting engineers when they prepare plans which are not carried out.

S.

FISON'S PATENT EXHAUSTING APPARATUS.

SIR,—Having noticed in your issue of the 13th inst., in the list of the "Register of New Patents," that of Mr. Fison's patent Exhausting Apparatus, I would make it known, through your columns, if you will allow me, that any one interested in gas manufacture wishing to judge of the practical value of the apparatus, can do so by visiting these works, where we have it in operation, and find it a very satisfactory system of exhaustion.

HARRY WIMHURST.

Gas-Works, Andover, Nov. 16, 1877.

A VOLUMETRIC METHOD FOR ESTIMATING SULPHUR IN COAL GAS.

SIR,—Kindly permit me to make a few remarks on Mr. Wright's letter in your last issue. The method he proposes is open to several objections—first, that ammonia vapours must always be present during the test, and, consequently, nitric acid would be formed, which would be reckoned as sulphuric acid in the result of the experiment, so indicating more sulphur than is actually contained in the gas. Mr. Wright mentions this fact as a source of error in the evaporation method, but fails to see that it applies equally to his own.

Another objection is that, during the ebullition of a liquid in which the evolution of carbonic acid gas is going on, a loss is occasioned by the spurting of minute drops as each bubble breaks. This may readily be seen by any one on boiling a solution of bicarbonate of soda, or sesquicarbonate of ammonia. Possibly, these two sources of error counterbalanced each other in Mr. Wright's experiments, which would explain the good results he obtained.

The last-mentioned objection may be removed by using a long-necked flask, instead of an open beaker; but the expulsion of the ammonia would thereby be retarded, and more time required for its complete evaporation; indeed, I should not feel safe until at least two-thirds of the liquid had been boiled away. I would also point out the great liability to error any one but a most careful operator would be subject to, as any ammonia left in the liquid would vitiate the result. The use of tincture of cochineal as an indicator, in the manner described by Mr. Wright, is very unsafe, as free carbonic acid *does* materially affect its colour; and, unless the liquid is boiled after each addition of standard acid, it is extremely difficult to say when the point of saturation is reached.

A third source of error is the possible impurities in the carbonate of ammonia used, most of which would add to the amount of sulphur indicated. I may mention that the use of carbonate of ammonia *in the cylinder*, instead of round the burner, of the Referees apparatus, and the substitution of a short upright eduction-tube for the ordinary one, has been practised by me, and by Mr. Heisch and others, at my suggestion for the last three years.

Your readers, I trust, will pardon me for directing their attention to my paper on this subject, which you kindly published in your JOURNAL for March 27, 1877. At the latter part will be found the method I recommended. I wish to add that, by using the liquor condensed in the lower cylinder for washing out the upper cylinder, and completing with distilled water, there is no need to make the correction for the sulphur contained in it.

W. C. YOUNG, F.C.S.,
Metropolitan and City of London Gas Examiner.
Chemical Laboratory, 117, *High Street, Poplar, E., Nov.* 19, 1877.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

WEDNESDAY, NOV. 14.
(*Before Justice* FRY.)

THE ATTORNEY-GENERAL *v.* THE GASLIGHT AND COKE COMPANY.

Mr. KAY, Q.C., Mr. ASTON, Q.C., Mr. WEBSTER, and Mr. BARDSWELL appeared for the relators; Mr. BENJAMIN, Q.C., Mr. HORACE DAVEY, Q.C., Mr. A. L. SMITH, and Mr. HORNELL for the company.

Mr. KAY, in opening the case, said it was one of a class familiar to the Courts of Chancery within the last 20 years. It was simply an information against the company for creating a great nuisance by certain works which they had established within the neighbourhood very near to West Ham, and the information was presented at the relation of the Local Board of Health for the district of West Ham. The statement of claim showed that the relators were the urban sanitary authority of the district. In the year 1874 a company, known as the Imperial Gas Company, began to manufacture gas at Canning Town, and from that time until their amalgamation with the defendants they continued to manufacture gas there. On Jan. 1, 1876, the Imperial Gas Company became amalgamated with the defendant company. The defendants were simply a trading company, associated for the purpose of profit. At the date of the amalgamation, the manufactory at Canning Town was conveyed to the defendants, and all the rights of the Imperial Company were vested in them. Ever since Jan. 1, 1876, the defendants had manufactured gas at Canning Town. The offence alleged was that, from the time of their commencing to manufacture gas at Canning Town, there had been on various occasions proceeding from the manufactory an abominable stink, of such a volume and intensity as to be a nuisance, and which had injuriously affected the comfort and health of the district. The relators had been informed, and it was the fact, that the stink which had issued from the manufactory was, in a great manner, caused by the escape into the air of sulphuretted hydrogen, which was given off by the substances used for the purification of the gas. The defendants had been repeatedly warned by the relators that legal proceedings would be taken to compel them to abate the nuisance; but, nevertheless, they neglected to do so. During the last four months preceding June 27, 1876, certain particular occasions were mentioned on which the stench before mentioned had issued so intensely as to be a very great nuisance. The defendants had created a public nuisance within the district, and they had injured, and continued to injure, the sanitary condition of the district and the health of the inhabitants; and the prayer was that they should be restrained by injunction from carrying on the business of the said manufactory at Canning Town, or any of the processes carried on by them so as to cause a nuisance. The defence was a simple denial of the fact.

Justice FRY: A denial of the fact, and an allegation that there are other works in the neighbourhood which cause a nuisance, and that they are under an obligation to make gas.

Mr. KAY did not understand the other side alleged they were under any obligation to make gas in any place where the making was a nuisance to the neighbourhood. They had liberty to choose a place, and to make gas where it was no nuisance, or should make it in such a manner as not to produce a nuisance.

Justice FRY said he presumed the law was plain that, if they could not do it without creating a nuisance they might not do it.

Mr. KAY: Where the Act of Parliament was of such a nature as to contemplate a nuisance being created, and enabled persons to carry on that which must produce a nuisance, the nuisance was legalized; but the onus was on the defendants to show that the Act of Parliament was of that nature, and that the works could not be carried on without producing a nuisance. It would appear, in the course of the evidence, first of all that this was, beyond all question, within the well-known definition of Vice-Chancellor Kindersley, a public nuisance. The West Ham district contained at present about 100,000 inhabitants, so that it was a thickly-populated district, and, of course, one in which the existence of a great public nuisance would be a very serious matter indeed. It was easily to be believed that a district so near to London, if there were not reasons to prevent it, would rather increase than otherwise. There were many gentlemen's houses there formerly, perhaps more so than at the present time. In Patterson's case against this company, they had a great deal of discussion with regard to the other works of the company at Beckton. His lordship was counsel in that case, and that would render it unnecessary for him to refer to it at length. At Beckton there was a comparatively small population. The company had also works at Bow, and he thought his lordship would find that since 1876, when this company took over the works at Canning Town from the Imperial Gas Company, they had very much enlarged them at an enormous expense, and had very much increased their capacity and power.

Justice FRY remarked that the main issue was one of fact.

Mr. KAY said that was so. He conceived it was no part of the case of the Attorney-General, or, indeed of a private plaintiff, to show that a nuisance of this kind could be very easily obviated, but incidentally it would appear that there was no difficulty. The relators would give proof as to the mode in which the nuisance was probably created. His lordship would remember that the process was that the gas, when it issued from the retorts, was charged with tarry matter, ammonia, and to a large extent with sulphuretted hydrogen, and with other compounds, about which there was a great deal of evidence in Patterson's case as to the best mode of getting rid of them. The Government had required that those sulphur compounds should be minimized, and examiners were appointed to ensure that the gas sent out to the public should be of a certain purity. The process

of purification was that the gas was passed, after leaving the retorts, through scrubbers, which deprived it of the tarry matter and the ammonia, which mixed readily with water. Then there remained in the gas carbonic acid, sulphuretted hydrogen, and other sulphur compounds. Sulphuretted hydrogen was in very great quantity, and Mr. Patterson's invention consisted of a mode of separating the carbonic acid first, then the sulphuretted hydrogen, and using the compound which he made in that way for getting rid of those indeterminate forms of sulphur which remained in the gas. The mode adopted by this company, and all others, was that the gas was passed into purifiers, which were large enclosed vessels filled with caustic lime; the lime absorbed the carbonic acid and passed on the sulphuretted hydrogen, and it was kept under that influence for such a time as to ensure it being done, the object being to pass the sulphuretted hydrogen from those purifiers to the other lime purifiers which followed, and this took up the sulphuretted hydrogen from the gas. He need not say that that was one of the most deleterious gases that could possibly be introduced into the air. When they took out the lime it was in a very foul condition, and the name by which it was known was "blue billy." He believed the scientific name was sulphide of calcium. Then the gas was purified by having what remained of the sulphuretted hydrogen in it taken out by oxide of iron, which was comparatively an innocuous process. It would appear that the most objectionable part of this process, with reference to public comfort and convenience, was the time at which the purifiers were opened in order to remove the foul lime. Directly the foul lime was exposed to the air it liberated sulphuretted hydrogen in great quantities. It was a rotten egg smell. There were modes of doing this which obviated it. For instance, part of his evidence would be that it was easy to remove the lime from the purifiers without exposing it to the action of the air, or for so short a time that very little gas could escape; and the best evidence in the world that this could be done was that at other works of the same company the nuisance did not exist as it existed before this action was brought; and, further, that since the action was brought the company had found means to mitigate the nuisance to a very great extent. Before the action they simply opened the purifiers; and then men with mufflers over their faces, to prevent them being stifled, emptied the foul lime into barrows, and the stuff was put on trams (except that occasionally it was covered by a little small coal), and then taken to barges on the Thames and so conveyed away. He should produce witnesses who would say that at the time when the purifiers were opened the stench was enough to make human life almost intolerable. They would show that the stench had existed in such a degree that for a distance of two miles from the works it made houses uninhabitable. Witnesses would show that on many occasions they had experienced this nuisance and annoyance from the works.

Justice Fry asked whether the provisions of the Metropolis Gas Act, 1860, compelled the defendants to make gas at all, or compelled them, if they made it, to do it well.

Mr. Kay said there was no compulsion upon them to make at all; but if they made, to make well. The Imperial Gas Act of 1854 was the one which applied to the company whose business had been taken over by the defendants. Section 6 provided that nothing in the Act contained should prevent the company from being liable to an indictment or information for nuisance, or any other legal proceedings to which they might be liable in consequence of their operations. The Act of Parliament authorizing the Imperial Gas Company to construct their works at Canning Town was in 1869, with which the Act of 1854 was, he believed, incorporated.

Mr. Benjamin said that the Act of 1869 recited that under the Act of 1860 the company were under an obligation to manufacture gas.

Mr. Kay said it was recited that they were under an obligation to supply a particular district with gas, not the West Ham district, and the land was described as well adapted for the undertaking, and that it was expedient that the company should be authorized to purchase. Then there was an express authority to purchase the land, provided that nothing in the Act contained should prevent the company from being liable to an indictment or information for nuisance, or any other legal proceedings to which they were liable in consequence thereof. Under that Act the company took the land. *The Attorney-General v. The Corporation of Leeds* was an identical case. There they were authorized by the Act to make sewers, and discharge the foul water of the sewers into the river Aire, and although by express words they were authorized to do that, and although they had constructed, under the eyes of the relators, a large system of sewerage at an enormous expense, yet when they did pour the foul water into the river Aire under the express provision of the Act of Parliament, the answer made by the judges to their contention that they were authorized to do so was, "You are authorized to do it so as not to commit a nuisance, and if you commit a nuisance you are liable." He understood the other side to say that, being bound to supply gas to a particular district, they were thereby at liberty to use land in another district, so as to commit a nuisance in that district.

Mr. Benjamin said the point was that they were obliged to supply gas.

Justice Fry asked where the obligation was upon them to do that? If they supplied gas they were bound to do it in a certain manner, but for ought he saw they might shut up their works.

Mr. Benjamin said they were incorporated for the purpose of supplying gas.

Justice Fry said the Act of 1860 was apparently a bargain between the gas companies to assign districts, but not an obligation upon them to supply gas.

Mr. Benjamin said the point he wished to mention was that, supposing the company were obliged to supply gas, then the 52nd section of the Act compelled them to supply gas of a particular purity, according to the direction of the Referees, and they had been required by the Referees to furnish gas of a particular purity. Then the point was that gas of that purity could not be supplied without the process which they were conducting. They could supply gas without creating a nuisance if they were allowed to supply it of a less purity.

Mr. Kay replied that the Referees had no power to authorize a nuisance, and if the Referees were to require the company to supply gas which they could not make without creating a nuisance, the Referees would violate their duties. But the Acts of Parliament carefully kept the rights of the public intact. They showed that everything was to be done subject to the rights of the public to prevent nuisance. He contended that the company were not under any obligation to supply gas, and, therefore, the basis of the arguments failed. If they were, they were bound so to carry on their works as not to create a nuisance, and the standard of purity for the gas was one to be attained without creating a nuisance. Throughout all the Acts there was the same provision which was contained in the general Acts, that the great powers given were to be exercised so as not to create a nuisance. He, of course, entirely accepted the doctrine established by *St. Helen's Company v. Tipping* (11th House of Lords), which had reference more especially to personal discomfort. He understood it would be endeavoured to be shown that Canning Town was eminently convenient for gas-works, because there were other manufactories in the neighbourhood of an unsavoury nature. But the doctrine of a nuisance being legalized by its being in a convenient place was entirely exploded. The House of Lords no doubt said it was right to consider all the surrounding circumstances, and the Court would not interfere for trivial inconveniences. No justification for a nuisance could possibly be found in the fact that there were other works in the neighbourhood which produced nothing like the same extent of nuisance. But if that were otherwise, the company could not say, "Because the neighbourhood is unsavoury already, we will add another, and render life almost insupportable." The sort of case that he intended to prove was that from these works there was a tremendous emission very constantly, though not continuously, of sulphuretted hydrogen in large volumes, and that the effect of this, on those who experienced the fumes, was to produce nausea, retching, and vomiting, and the effect of breathing an atmosphere impregnated with sulphuretted hydrogen was to predispose people to disease, and those who were of weakly frame were very much injured. It was injurious to everybody, but no doubt more or less according to the strength of the individual.

Justice Fry: You allege injury to health.

Mr. Kay: Yes, my lord.

Justice Fry said no doubt people had a right to health, even at the East-end of London.

Mr. Kay would admit that this, for a populous neighbourhood, was, perhaps, as good a place to put gas-works in as could be found; but there was nothing to permit the company to commit anything like the nuisance they did. If the defence suggested were worth anything at all, the onus would be upon the company to show that they had taken every precaution they could take to prevent a nuisance; and if they raised any case of that kind, he would ask his lordship to refer to the reports of the Gas Referees, which would show that they were of opinion that proper precautions had not been taken. The case was a very simple one, and he would now call his evidence.

Mr. *William Allen*, examined by Mr. Aston.

I reside in Stratford, in the neighbourhood of the works in question, and am inspector of nuisances to the West Ham Local Board of Health. I have been so employed 11 years. I know the company's works at West Ham. They are called the Bromley, or the Imperial Gas-Works. I have memoranda which I have made from time to time of certain matters that I noticed in connection with the works. In 1874 my attention was called by the inhabitants of West Ham and Stratford to a very bad stink. After investigation I found it came from the Imperial Gas-Works. It was part of my duty to take notes of complaints made by inhabitants, and investigate the origin of them. As a part of my duty I made entries from time to time in connection with observations I made. I produce the books in which those entries were made. They were made by myself at the time, day by day. On June 1, 1874, I visited the Imperial Gas-Works in consequence of complaints made at the town-hall of Stratford—that is the office of the sanitary authority. I went to the works, and found a purifier being opened; there was a bad smell. I know the smell caused by sulphuretted hydrogen. I perceived that smell arising from the purifier; it was like rotten eggs.

By the Court: I found the purifier being opened, and the men were taking out spent lime, or "blue billy."

Examination continued: On the 9th of October I called on Mr. Wright, the engineer of the works, and told him of the complaints of the smell arising from the works. Mr. Wright said he was using the best means he possibly could, and that there was no nuisance. On that particular day there was no purifier being opened. There was nuisance before that.

By the Court: On the 9th of October there was not any nuisance. On the 29th of May I was in Plaistow, when I perceived the same smell—I mean the rotten egg smell. Between the 1st of June and the 9th of October I have no entry of any nuisance. During all that time I was about the neighbourhood.

Examination continued: Between the 1st of June and the 9th of October I do not recollect the recurrence of the bad smell. On the 10th of October I visited with Dr. Drake, the medical officer, the Imperial Gas-Works at Canning Town, to find out whether the smell we perceived on that particular day came from those works. I went to the works on that day because of the complaints of the inhabitants.

Justice Fry said he did not see how the number, extent, or character of complaints was evidence. It was sufficient to show that he went in his official capacity.

Examination continued: On the 10th of October the smell was caused by one of the purifiers being opened. It was open when I arrived there. The smell was very bad. On the 27th of October I did not make a report. I was in High Street, Plaistow, and I fancied I smelt something; but I was not satisfied in my own mind what it was, or whether it was the same smell. I was very sure there was a smell. The High Street, as the crow flies, is about 2 miles or 2¼ miles from the works. I was ordered by the board to make a complaint to the manager of the company's works on the 4th of November, 1874. I took a letter from the clerk, by order of the Board, and delivered it at the manager's office. I did not write that letter. On the 4th of January, 1875, or about that date, I perceived bad smells in the locality; it was the same smell as of rotten eggs. I first smelt it in Plaistow Lane; that would be about a mile from the works. Upon that I officially made a report to the medical officer. On the following day—the 5th of January—I again detected evidence of the existence of the bad smell in the Romford Road. That was a smell of the same character, and it would be between two and three miles from the works. I am able to give reasons for supposing that that smell arose from a particular locality, and that is, smelling this particular smell so many times, I really could detect it in any part of the parish. It is a smell I could detect at any time—a curious sort of smell. I did not ascertain that there was anything being done. On the 5th of January I noticed the smell between four and five in the evening. I called Dr. Drake's attention to it. On the 17th of June, 1875, I received complaints with reference to the smell at that time, from Dr. Levick, of West Ham.

Justice Fry said the fact of there being complaints, and, therefore, putting the witness in action as an official, was evidence; but the evidence need not go beyond that. He could not attend to the mere fact that somebody had said he smelt it.

Examination continued: On June 30, 1875, I went to the gas-works because of the complaints made to me. I found a purifier being opened, and I traced the smell.

By the Court: I first perceived the smell on that day in West Ham, near to the West Ham Church, about half a mile. I followed it from there down to the works, and it got worse.

Examination continued: When I got to the works I found the open purifier being charged with fresh lime. I also saw the foreman, and told him what a nuisance it was. On Sept. 20, 1875, I perceived a bad smell in West Ham. Dr. Drake was with me at the time. In consequence of that I visited the Imperial Gas-Works.

By the Court: As I went thither, I smelt very little indeed. I first smelt it in West Ham. As I went towards the works it got less. When I got there it was not so much as it was in West Ham. I think it was caused by a large barge filled with spent lime, or "blue billy."

Examination continued: I do not recollect that the officials at the works told me what they had been doing that day. I saw no purifier open on that occasion. One had been open. I saw the stuff lying about. In my opinion it had been open to fill the barge, and there were traces of the

lime having been carried. On Sunday, the 24th of September, my attention was called, between the hours of ten and eleven, to a very bad smell in West Ham and Stratford. I was at home at the time. At that time I lived at West Ham. That would be about a mile from the works, going round the road. Dr. Drake called my attention to it, so did Dr. Shipston. Dr. Drake met me in the lane, and I went on to the gas-works. As I proceeded towards the works the smell was fearfully strong that morning all the way down. I had no doubt as to where the smell proceeded from. I felt confident that it proceeded from the gas-works. I went in and found one of the purifiers was emptied. I saw the "blue billy" which came out lying in a heap; it was not covered over as usual.

By the COURT: I perceived the smell after my attention was called to it, but not before. I did not catch it in my house. As soon as I got into the lane I did.

Examination continued: I reported to the clerk of the board.

Justice FRY said he did not see how those reports were material.

Examination continued: On the 2nd of October I and Mr. Everest visited the gas-works at Canning Town.

Justice FRY said what he smelt, or saw, or felt was material, but not why he went, because it might be idle curiosity.

Examination continued: The smell I perceived that day I knew must come from the works. It was in consequence of complaints received that we both went. I did not notice the smell before I started, but as we were going along we did. We went down the Abbey Lane, and I smelt the sulphuretted hydrogen caused by one of the purifiers being emptied as I found when I went to the works. I have no doubt the smell was caused by the foul lime being removed from the purifier. I perceived the smell in Abbey Lane about half a mile from the works. On the 9th of October I perceived a bad smell from the gas-works. I went to the works in consequence of complaints from the inhabitants of West Ham. On the 12th of October, 1875, I perceived a smell, and in consequence went to the gas-works. I found a purifier being emptied. I have no doubt that caused the smell. I perceived it on that morning between eight and nine at my house at West Ham. On the 4th of November, 1875, I perceived a bad smell at my own house, and in consequence of that Dr. Drake and I visited the works immediately, and found a purifier being opened, and also one being charged with fresh lime. On the 5th of November I visited the works, and found a purifier being emptied, and I traced the smell to the works.

Justice FRY desired to know the days on which the witness perceived the smell, traced the smell, visited the works, and found a purifier open.

Examination continued: On Dec. 18, 1875, the same thing happened, and on Dec. 31, 1875. On Jan. 1, 1876, the 17th of January, and the 21st of January, Mr. Angell, the surveyor, and I visited the works, and found a purifier being emptied.

By the COURT: I myself perceived the smell at the town-hall, Stratford.

Examination continued: On the 15th of February I traced the stink down to the gas-works, and found a purifier being emptied. On the 21st of April there were complaints made by different people in Stratford. I visited the works and found a purifier being filled with fresh lime.

Justice FRY said evidence as to the state of the works was material, but what somebody told him on that day about having smelt something he should not admit as evidence.

Examination continued: On the 21st of April I visited the works, and found a purifier being refilled with fresh lime. I went with Dr. Drake and Mr. Mulley. On the 27th of April I again visited the works, in consequence of complaints being made. I did not perceive any smell on the way. When I got there I found a purifier being emptied.

By the COURT: On the 12th of October and 4th of November, 1875, I perceived a smell at my own house; but, with the exception of those two days, I have never perceived it at my own house. From the 29th of May, 1874, down to the 25th of May, 1876, I resided at Stratford. I removed to West Ham in 1876, and back to Stratford just before last Christmas.

Cross-examined by Mr. BENJAMIN: I removed because my district was changed. I do not recollect what time that was. During the whole time I have never smelt the smell but twice in my own house. I have smelt it when I have been out worse than the other smells about there. The plan produced and shown to me represents the position of the gas-works, the holders, the purifiers, retort and engine houses. I know the manure works marked on the plan. They make blood manure there. The smell of it is very offensive when you get close to the works. Then there is a tar distillery. You do not get the same sort of smell from a tar distillery as from a gas-works. I do not understand the process of tar distilling. I do not know what are the odours given out by a tar distillery. I have been at the works. I have smelt the tar.

By the COURT: I have been to the tar distillery, and smelt there a smell of tar, but no other smell.

Cross-examination continued: That smell is not perceptible far from the works. Then there are oil and stearine works close by. I have been to those. It is not an unpleasant smell; it is a greasy smell, but not offensive. Then there are chemical works close by, you get from them a sulphurous or vitriol smell. Then near to them were varnish works which have been closed two years. I cannot say whether they were at work in 1874, because I was not the officer of that district at the time. I gave evidence of the state of the gas-works in 1874, but I cannot tell whether the varnish works were open at that time. Then there is another set of chemical works. They make all sorts of drugs. I have not perceived any nasty smells from them. Then west of that there is a sewage pumping-station, that smells when you go into the building, but I have never smelt it outside. The india-rubber works have been closed up a long time. I cannot say whether they were closed in 1874, because I was not then the inspector for that district. There are on the other side a whole series of works between the gas-works and Stratford. I cannot speak as to the soap-works.

By the COURT: I have been about six months officer of the district where I am now.

Cross-examination continued: I was a witness when there were proceedings against the Imperial Company at the Stratford Police Court. That was in December, 1875. On that occasion I gave it as part of my evidence that I had made it my business carefully to watch the premises in consequence of complaints of the smells coming from them. I cannot say whether I said I had observed the smell about half a dozen times. I made every entry in the book to which I have referred this morning at the time when it bears date. The book is kept in my own handwriting. I have always entered the complaints, if not on the same day, at least on the second day; but on May 29, 1874, I reported that between five and six o'clock, coming through Plaistow, I perceived a very offensive smell, and found that it came from the gas-works at Canning Town. I made the entry the next day, or the day afterwards. The entry refers to between five and six o'clock in the morning. In May, 1874, I was watching the factory, and went out between five and six o'clock in the morning to trace the smell. On the 1st of June I have said that I visited and found a purifier being emptied of spent lime. I do not think I smelt that smell myself. When I smelt it myself I put it down. I have reported complaints by others. I did sometimes put in my book that the smell was caused by emptying the purifiers because other people told me so. When I have had complaints come in I have gone off to see for myself. When people that I believed to be truth-telling people said there was a smell coming from the gas-works, I did not enter it without going myself—I think not—but I will not swear it. I can remember some of the days on which I visited the works without looking at the books. When I have not put that I smelt the smell I did not smell the smell myself. Whenever I have made a report that there was a smell coming from there, I occasionally did so on what people told me.

Justice FRY: Have you ever made an entry tracing the smell to the works, except where you yourself have personally traced it?

Witness: I think not; I have always been very careful.

Cross-examination continued: I am not sure that I have not put down that the smell came from the works from what other people told me. I could not answer that question without going through the books. Referring to the entry of the 4th of January, 1875, I say I visited the works on that day. That was not one of the days when I made a report because somebody told me. On the 5th of January I did not go there. I made that entry because of what I was told.

By the COURT: There is no mention made that the smell was caused by cleaning out the purifiers.

Cross-examination continued: The purifiers are generally emptied, I am told, from six o'clock in the morning. I have found them at ten and eleven when I have been there. I do not know that they are emptied after ten or eleven in the morning. I have not found a smell coming from the works except when they have been emptying the purifiers.

By the COURT: As far as I know, the emptying of the purifiers is the sole cause of the nuisance.

Cross-examination continued: I cannot be certain about distances; I cannot say that High Street is two miles from the works.

Re-examined by Mr. ASTON: On certain occasions I personally traced the smell, and visited the gas-works to find out the cause. When I have said that I traced the smell, I am positive that I did. The course I took with reference to making notes was, that I had a small pencil memorandum-book, and at the time any observations were made by me I entered memoranda in that book. From that memorandum-book I copied the entries into the big one. In December, 1875, when before the magistrates, I think I had the books with me. I was not carried through the entries in that book as I have been to-day. On other occasions than those I have mentioned the smell was distinguished by me in going my rounds in different parts of the district, but not to trace it down. I have felt, in my own mind, it was the same smell. When I have endeavoured to trace the smell, I could not trace it to any other place than the gas-works. I am positive I could not trace that same smell to any other place. I know no works in the neighbourhood other than the gas-works which could produce that smell.

By the COURT: When I have smelt the smell it went on for a few minutes, and has continued more than that when I have been tracing it down. Then it has continued the whole time I have been walking down. When not tracing it I have never perceived it continue more than a few minutes. The smell has never made me ill, not even when I have been at the works.

Further cross-examined by Mr. BENJAMIN: I know the gas-works near Stratford; they manufacture gas. I have not been on the works, but I know they supply gas. I do not know how they purify their gas; but they are the gas-works supplying gas there. They are known as the West Ham Gas-Works.

By the COURT: They are very small in comparison with the defendants works.

Further re-examined by Mr. ASTON: The works have been there many years. I have known them 20 years.

Mr. *Robert Everest*, examined by Mr. BARDSWELL.

I am assistant-inspector of nuisances to the West Ham Local Board. I have held that office 11 years. I know the works of the defendant company. I have noticed a very offensive smell from those works. I made memoranda in the same way as the last witness. I perceived an offensive smell on Sept. 26 and Oct. 2, 1875. I traced the smell on those dates; it was very bad indeed. I went to the gas-works on Sunday morning, Sept. 26. When I got there, as I was crossing Stratford Broadway, between ten and eleven o'clock, I perceived a most offensive smell. I went down West Ham Lane, and met a gentleman, who complained of a very offensive smell. I proceeded with Mr. Allen to the works, and traced the offensive smell from those works. We went on the works, and saw some of the men emptying one of the purifiers. They were digging the lime out, and putting it on the flagging at the side of the purifier. The men were muffled, the stench being very bad. The cause of the smell was the emptying one of the purifiers of spent lime, or "blue billy." I went again on the 2nd of October; I noticed then the same sort of smell. Mr. Allen went with me. Those are the only two occasions upon which I have traced the smell to the works, and I am satisfied the offensive smell did arise from those works.

Cross-examined by Mr. BENJAMIN: The smell was quite as bad on the 2nd of October as on the 26th of September. I was not told there had been an accident that morning which caused the smell. I was not told that there had been a mistake made, and it was an exceptional case. I was examined before the magistrates at the Stratford Police Court. That explanation was given before the magistrates.

Mr. *Thomas Drake*, examined by Mr. WEBSTER.

I am a member of the Royal College of Surgeons, and Medical Officer of Health to the West Ham Local Board. I have resided at West Ham for upwards of 16 years, and for nearly nine years have been medical officer to the local board. During the last nine years I have resided at the same place until about a month ago. That was at Stratford Broadway, which is close to Stratford Green. The distance from the Bromley Gas-Works to my house is about a mile and a half. My practice is in the neighbourhood; it is a medium-sized practice. It is not among the poorer people. My practice lies all round the neighbourhood. I have smelt the smell from the Bromley Gas-Works. I believe it is sulphuretted hydrogen, with probably other compounds, but mainly sulphuretted hydrogen. It is worse than sulphuretted hydrogen, if anything can be worse. There is no mistaking the smell at all. The effect upon me has been to nauseate me, and it has actually made me sick. The earliest time I recollect when that smell was first perceived by me was about the middle of 1874; but I did not find out where it came from until October, 1874. I know of the existence of all the other works which have been referred to. The majority of those works had been in existence for some time before 1874. The smell that I have described is distinguishable from the smell which comes from those other works. It is a smell which, from its symptoms, is very easily distinguishable. Prior to 1874 I had never smelt anything of the kind from any of the other works in the neighbourhood. I have kept notes and memoranda in the course of my duty, and from time to time I made entries, at or about the time, in a small memorandum-book. I have made communications, in the larger note-book produced, to the Local Board. I smelt the same thing during the year 1875 a great many times; but I cannot say where without referring to my notes. I think I have chiefly smelt it in the morning time, about ten o'clock, although I have smelt it later in the day. I have known it continue two hours. It has frequently lasted as long as that when the wind was south-west. I have not noted a one hundredth part of the times

I smelt it. I have called the attention of the inspector of nuisances to it. I first traced it to the defendants works on Oct. 10, 1874. I went to the works, and have no doubt that it proceeded from them. I have a note of my visit to the works on that day, and my report to the board in three days time. On the 4th of November I observed the smell, and I went with Mr. Allen to the works, and found they were opening a purifier. The smell from it was very bad. They were taking out spent lime. The lime emitted the smell I complain of. I detected it as being sulphuretted hydrogen, but there was something more than that. On the 24th of Dec., 1875, I was at Upton, and smelt it very badly there on that day—that is, I should say, over two miles from the works. I was visiting the convent there. On the 31st of December my note is: "Awful stench in my bed-room, waking, and nauseating." That is the fact. I presume the smell came down the chimney. On the 1st of January I have also a note that it was very bad between nine and ten o'clock at my own house. On the 21st of January it was very bad at my house near ten o'clock. The wind was south-west. On the 30th of January it was very bad at my house about half-past ten. I do not know of any factory in the parish that works on a Sunday. On the 15th of February it was very bad at my house at ten o'clock. On the 21st of April I was awoke up at seven o'clock by the smell from the gas-works. I took a cab, and traced the smell to the emptying of the purifiers.

Mr. WEBSTER: In the course of your practice have you had complaints made by persons you have attended?

Mr. BENJAMIN: I do not object to the question, but it must not be exactly in that form. I am quite willing that it should be whether in his practice he has known anybody made ill by the smell.

Justice FRY: I do not quite see how statements by a patient, not followed up by the doctor, can be evidence by the doctor.

Mr. WEBSTER: Your lordship sees this is an expert witness.

Justice FRY: You may put it generally.

Mr. WEBSTER: Have you found in your practice the presence of symptoms such as would be accounted for by sulphuretted hydrogen?—I cannot exactly say that.

Justice FRY: Has a patient told you what he or she was suffering from, and have you found in your practice that it was produced by sulphuretted hydrogen?—I cannot say that. But I can say that it has made me sick.

Has there been in your practice any disease or illness present which you can attribute to this smell?—No.

Mr. WEBSTER: Assuming the smell to have the nauseating effect to the same extent upon other persons as upon you, is it or not, in your judgment, deleterious to health?—I should say it is very deleterious to health.

Justice FRY: Speaking from your own experience of the effect of the smell, what do you say?—I say that if the wind was always south-west, and we always had that smell, we could not possibly live in the place. Whenever it exists it oppresses, and affects the general health of the public.

Examination continued: I have been at the works eight or ten times. I have seen spent lime spread about the works; there is an immense accumulation, all the roads are made of it. The action of the atmosphere on spent lime is to make it give off sulphuretted hydrogen. I know the West Ham Gas-Works. They were there before I went to live at the place. I have never noticed any smell of the kind from them outside. When I have been in the works I have occasionally got a little smell of it.

By the COURT: They do not use the lime process.

Examination continued: I have seen the process of manufacture there. I have no doubt whatever as to where this smell proceeds from. It comes from what we call the Imperial Gas-Works. From the middle of 1874 down to the month of April, 1876, it has occurred with more or less frequency according to the direction of the wind.

Cross-examined by Mr. BENJAMIN: On the 21st of January, 1876, I smelt it about ten o'clock at my house. The same smell has come from the gas-works when they emptied the purifiers. I have no doubt, with the quantity of spent lime lying about, there is always a smell given off. I say there is a continuous nuisance from the works, but more when they are emptying the purifiers.

By the COURT: Assuming the purifiers were not being emptied or open, I cannot say whether there would be any nuisance perceptible at a distance. I cannot say how far you can perceive the smell—not, perhaps, 50 yards off.

Cross-examination continued: On the 21st of January, supposing it to be established that no purifier was opened that day, I am quite certain the smell came from the gas-works, and I should think, if they say no purifier was open, they made a mistake in the entry. I am not a chemist; I do not know that in the last processes of distillation of tar it gives out large quantities of sulphuretted hydrogen. There would be no smell scarcely from carbonic acid. I cannot distinguish between "blue billy" and carbonate of lime by looking at it, but I could tell from the smell. I can swear that in the course of my practice of 11 years I have come across a patient who had been made sick by this smell—namely, myself; I have never seen another person sick from it. I have met with a great many patients who have complained. My patients have told me that they have been affected by it.

Justice FRY: As medical officer, tell me to what extent the health of this district has been affected, in your judgment, by the defendants works?—If you ask me if any particular disease has been caused by these works, I cannot say that I know of any disease, but I have been almost worried to death by people complaining that their lives were made perfectly unbearable by it during the last two or three years.

From your knowledge and experience in the district as medical officer, can you say that they have been made ill by the defendants works?—It is a very difficult question for me to answer. I can only say that people tell me their lives are rendered unbearable by this stench, and that they are oppressed and low; and seeing that I have been made sick by it, I can believe what the people say.

Do you find present a general low depressed condition of health, which, in your judgment, is attributable to these works?—No.

Cross-examination continued: I think I understand the process of purification at the West Ham Gas-Works. It differs in this, that they are not bound to take so much sulphur out of the gas, and do not use the lime process. They leave a certain amount of sulphur compounds in the gas which this company take out, I believe. I know nothing of any other gas-works. I have smelt a sulphurous smell inside the West Ham Gas-Works on one or two occasions, but not outside. I know the Imperial Gas-Works give out a bad smell. There are several bad smells which come from other works, but not with that wind. I believe the stearine-works are now perfectly innocuous. It is true that the smell of greasy compounds creates nausea. Any smell that is bad will make you sick. I persist in saying that the smell of these sulphurous compounds made me sick.

By the COURT: I have been made sick only once.

Cross-examination continued: I am not in the habit of taking too much over night. I do not say I vomited, because I had nothing to vomit, but I retched up some froth. That was the only time I retched, but the smell of the gas-works has had a very injurious effect upon me. It has constantly upset me.

Re-examined by Mr. KAY: The works at West Ham are very small as compared with the defendants. There is a particularly bad smell from the leather-cloth works, but it does not extend for any distance. The smell from the gas-works is very easily distinguishable. A greasy compound smell has no resemblance to this smell. When I was nauseated it was the smell from the gas-works. Of that I have not the slightest doubt. The smell has the effect that it depresses one, and renders one unfit for anything. I am a very healthy man indeed. The effect would be worse on those who are delicate, and obliged to be indoors. It would be very bad. In case of illness induced by other causes, the smell would be very injurious, I have not the slightest doubt. It would depress the pulse, no doubt, but I did not feel my own pulse. I could not refer the feeling of depression to any other cause than this smell. If a person were ill it would tend to make the disease worse.

By the COURT: Different persons are differently affected. It is possible that I, by some idiosyncrasies, might be affected by this smell worse than others would be; but I think my apprenticeship of seven years at West Ham has made me used to it.

Mr. *Lewis Angel*, examined by Mr. KAY.

I am a member of the Institution of Civil Engineers, and engineer to the West Ham Local Board of Health. I have been so between 10 and 11 years. I reside at the Grove, Stratford, which is about 1¼ mile from the defendants works, as the crow flies. I know West Ham Park. It is intended for a place of recreation for the inhabitants of West Ham. I have frequently experienced the smells at my house when the wind was in a southerly or south-westerly direction. I am able to say, from examinations made, that they came from the defendants works. The smell was sulphuretted hydrogen, and (if you could possibly fancy it) that putrid. It is something worse than rotten eggs. I have frequently experienced this in the house before I got up in the morning. The effect is exceedingly nauseating. This smell commenced soon after the works began—I think in 1874. The works are very recent works. The defendants when they took the works enlarged them very much.

By the COURT: When I first perceived the smell it was as bad as it is now—very bad.

Examination continued: The smell was worse after the works were enlarged. I have entries made in my diary at the time. The first is an entry of Jan. 1, 1876: "At half-past nine I smelt the gas pervading the house." On the 17th of the same month: "9.45, wind south-west; strong smell from the Imperial Gas-Works in the house." There is no mistake about the smell. On the 21st of January I smelt the same in Stratford, and having occasion to go down that district, I drove direct into the works, at eleven o'clock. That morning also complaints had been made to me. When I got to the works only one purifier was partly open. I saw Mr. Wright, the manager of the works. He was astonished that any smell could get over Stratford on that occasion, because it was a sort of irregular proceeding; it was not a regular clean out. The plate on the harness turned perfectly black while I was in the works. The number of inhabitants in the West Ham districts exceeds 100,000. The great mass of the people are of the working class. On April 28, 1876, there was a great smell from the defendants works all day. On the next day I smelt the gas in bed. The smell has been better within the last year. I have only noticed it very occasionally, and not so strongly or so often. I remember the occasion when the company promoted a Bill in Parliament last session. I never saw that Bill. The defendants came to me to ask me to prove a nuisance, and I appeared before the committee of the House of Commons, and gave evidence of the very great nuisance there was. Mr. Wright applied to me on behalf the company. He came to me early one morning to say that they had a Bill in Parliament, and thought my evidence would be very valuable as to the great nuisance of the works in my neighbourhood. I gave evidence that the nuisance was one of the most intolerable I had ever experienced. That is an accurate description of the nuisance. The company called me to give evidence, knowing the kind of evidence I was going to give.

Cross-examined by Mr. DAVEY: The object of the Bill in support of which I was called was to relieve the company from the obligation of reducing the sulphur compounds. The Bill failed. I am not an expert in gas-making. I know they use oxide of iron at the West Ham Gas-Works. They do not use lime purification to any extent. They are not under an obligation to reduce their sulphur to 20 grains per 100 feet. I remember saying that the defendants admitted the nuisance, but that they could do no more to obviate it. I remember saying that I had formed an opinion that they were doing all they could with their appliances. I have no reason for changing that opinion. I believe the company are doing their very best, and are also making a smell at the same time. On the 21st of January I saw one purifier partially open. The entry I have in my diary is that Mr. Wright said it was one of the acid purifiers. I do not know whether it was taking out the carbonic acid or ammonia. Mr. Wright expressed great astonishment at the smell having reached us that day. They were doing nothing whilst I was there.

By the COURT: I cannot say that I saw traces of recent taking out of lime.

Cross-examination continued: I will not undertake to say it was a lime purifier at all. I know which purifier it was, and can point it out on the plan. It was the one nearest to the offices or the one nearest to that. Assuming that not to be a lime purifier, but to be a purifier used exclusively to take out the ammonia, I do not know whether that would create any stench. I know there was a great smell, which induced me to drive to the works. I was examined before the Stratford magistrates against the company. I said on that occasion that the smell did not cause nausea and sickness with me, but that it did cause a great nuisance. It has caused a nauseating feeling with me. I lead a very active life, but I have been very much annoyed. Between my house and the gas-works there are a great number of factories—varnish-works, oil and stearine works, manure-works, leather-cloth works, two tar distilleries, and others. I do not know that in the process of distilling tar sulphuretted hydrogen is evolved. I have been to the tar-works frequently, but I have never smelt sulphuretted hydrogen to any extent. There is a considerable smell locally on the spot, but not far-reaching. I am not a chemist, and do not know whether the gas which emanates from the distillation of tar is or is not the same gas which is evolved from "blue billy," but I should say not. It is neither the same in kind nor extent. The smell I smelt about the tar-works was, generally speaking, a sea-side smell. I rather liked it. The stearine-works were offensive at one time, but they have been suppressed some months. I should think a year. I am perfectly familiar with the stearine smell. I know that as distinct from the gas-works. I know the smell from the sewage pumping-station. That is a local smell. Between my house and the gas-works there are several factories producing smells. I only went to the gas-works to run the smell down on one occasion. I did not go there on the 1st of January nor the 20th of April, nor on the 21st. On several occasions I sent the inspectors of nuisances off. Our local board have some sewage pumping-works in Canning Town, to the south-east of the defendant company's works. There is not a bad smell from those sewage pumping-works; it is a local smell, which you cannot smell 50 yards off. I will undertake to say that the smell from those works would not be detected half a mile off. I

am no friend of those works, and have advised the local board to remove them, but there is no smell 50 yards off. There has been a small extent of sewage matter exposed at these works occasionally. It is true that the West Ham Local Board, in May, 1877, were having another trial of the lime process at their sewage pumping-works; but it is not true that there was a fearful stench about the place. It is absolutely untrue.

Re-examined by Mr. KAY: On the 21st of January, when my harness was blackened, I did not smell anything very serious at the works themselves. I was astonished to find so little smell at the works of the company. I had smelt it at a distance. The harness was blackened in about twenty minutes. It is a fact that in the month of December, 1875, I was made to feel ill by the smell from the gas-works. There is no smell from any other works about this district of the same character as the smell from the gas-works. I have no difficulty in distinguishing the smell from the gas-works—it is notorious in the neighbourhood. There is no other smell in the slightest degree like it from any other works. The gas-works smell is the most powerful smell we know.

Mr. *Alfred Kennedy*, examined by Mr. WEBSTER.

I am a member of the Royal College of Surgeons, a licentiate of the College of Physicians, and a licentiate of the College of Apothecaries. I practise at Plaistow, and have done so for eight years. I remember the defendants works being enlarged.

Justice FRY: When were they enlarged?

Mr. BENJAMIN: In 1874 the company began making gas on a large scale. The first foot of gas was delivered on Jan. 1, 1874.

Mr. WEBSTER: There was another enlargement about a year ago.

Examination continued: I have noticed a smell from the gas-works; it has been nauseating. It proceeds from sulphuretted hydrogen or sulphur compounds. I noticed it first in the beginning of 1875. Up to last summer I have noticed it frequently in my own house, and when I have been driving about. My house is about a mile and a quarter from the works, due west. I am east of the works. I have noticed it generally in the morning and in the evening after six o'clock. It has lasted over an hour in the evening, and in the morning quite an hour. It has made me feel very sick, and taken away my appetite. Undoubtedly, in my judgment, it is prejudical to health. Assuming persons to be suffering from any disease, it would be hurtful to them. I know of the existence of other works about the place, and have smelt smells from them. There are no other works in the district from which a smell of the same kind proceeds. I have no doubt where the smell proceeds from.

Cross-examined by Mr. DAVEY: I have a pretty good practice. I cannot say I have a single patient who has been made ill by this smell, but it is prejudicial to health. My practice is all round the gas-works. When I have come home in the evening, after a hard day's work, the smell has nauseated me, and taken away my appetite. I smelt the smell on Tuesday week after five o'clock in the evening. My practice is to come home between five and six o'clock. I do not know that, whatever the smell is, it arises from the discharge of the purifiers.

Re-examined by Mr. KAY: It is not within my medical knowledge that the effect of sulphuretted hydrogen is to produce any particular disorder or disease. The effect is to lower the general tone of health, and make people more susceptible of diseases.

By the COURT: I am able to say that the health of my patients has been depressed by this smell.

Mrs. *Mary Amelia Scott*, examined by Mr. ASTON.

My husband is the vicar of West Ham, and we have resided at West Ham for over nine years. I remember in 1874 noticing a peculiar smell; that was in the winter of 1874-75. It was a putrid smell. I do not know whether it arose from sulphuretted hydrogen, but it was a smell we had not recognized before. I cannot say whence that smell arose.

By the COURT: Our house is near West Ham Park.

Examination continued: I cannot say whether it was a smell like that which would proceed from rotten eggs. I believe it has affected the health of the children. Some relations came to us in 1875, and they would have stayed longer, but they found the place very unhealthy for their children; they seemed always worse when this smell existed; they experienced a loss of appetite and a feeling of sickness. They did not remain. They did not give that as the exact reason, but they were constantly complaining of it. The letter produced of Oct. 2, 1875, was written by my husband to say that the smell in the house was intolerable. I wrote one about the smell, but I found I was writing to the wrong person. The members of my household complain of it very much, and they complain of the same symptoms. I remember on one occasion the sudden coming of the smell interrupting a garden party at our house. We all left the garden and went into the house, and shut the doors and windows. I have not the slightest doubt that that was the smell in question. The smell on all occasions has the same peculiarities. I could recognize it directly.

Cross-examined by Mr. BENJAMIN: I cannot say that anybody became ill from the smell. I do not consider they were ill enough to send for medical advice, but the smell greatly affected their health. I cannot say that any one ever had any serious illness from that smell. We know the cause, and wait till the cause is gone.

By the COURT: It depends entirely on the state of the wind. We have it if the wind is south-west; it varies in continuance from one to three hours.

Mr. *George Levick*, examined by Mr. KAY.

I am a member of the Royal College of Surgeons. I reside close to West Ham Church, about a quarter of a mile from the gas-works. I have resided there all my life. During the last three years I have experienced a very unpleasant smell. We have always some smell. The gas-works smell I have smelt for the last three years. I never noticed it bad before that. I have smelt it in my own house, and in different parts of the neighbourhood I have experienced the smell whilst I have been driving about. I have no doubt that the smell I speak of came from the gas-works. I have traced the smell to the works. I should describe the smell as a very rotten, nauseating smell. I know the smell of sulphuretted hydrogen well. This is sulphuretted hydrogen. I have smelt this smell 2½ miles from the works on more than one occasion. I made notes in my pocket-book, without any notion of giving evidence, to check the inspectors of nuisances. I did not make notes of all the times I smelt it; only just occasionally. Referring to the 6th of June, 1875, I have a note that, at five o'clock in the morning, I smelt it indoors. On the 16th of the same month, at half-past three in the afternoon, I experienced the smell of the gas-works. I smelt it on Wednesday, the 30th. I have an entry that on the 25th of July, early in the morning, I smelt it at my house. It was very bad indeed. I only made notes when it was worst. On the 23rd of December I have a note of the smell being very bad, and Mrs. Gray, a patient of mine at Plaistow, and several others, complained of it. I have no doubt the patients had reason to complain of nausea, and that it was produced from the smell, which was very prejudicial to their health. On the 19th of April, 1876, at two o'clock in the afternoon, it made me very unwell, and I nearly vomited my dinner. Nausea is the effect of sulphuretted hydrogen in the air. On the 19th, 20th, and 21st of April the smell was simply awful. May 24th, from seven o'clock till nine o'clock in the morning, the wind was south-west. It changed at nine o'clock to north-east, and the smell went. Since the 24th of May I have frequently experienced it. It has been more or less constant.

By the COURT: I do not know whether the general character of the smell has changed since May of last year. I should scarcely think a week has gone by without my smelling it, except the last three weeks, during the last three years. I believe the smell to be very detrimental to the health of the district. It would make people worse if they were ill, and if they were well it would make them ill. I agree in the evidence that it would tend to lower the system; I cannot attribute any specific disorder to the smell. I have known my wife, who is a delicate person, positively vomit from the smell.

Cross-examined by Mr. DAVEY: Until the last week or two it had been as bad as ever. On the 23rd of last month it was simply frightful. I do not agree that for the last year it has been much better. On the 19th of April, according to the entry in my diary, the gas-works smell made me unwell, and I nearly vomited my dinner. I do not know whether the discharging of the purifiers is always done in the early morning; but I have noticed the smell very frequently in the early morning. I have smelt it, however, at other times. If it be the fact that no purifiers were discharged at the gas-works, I still adhere to what I say—that on the 23rd of October it was simply frightful. I was in Stratford, about four o'clock in the afternoon, going up to a meeting of the local board, of which I am a member. I have never in my life complained of the smell from the leather-cloth manufactsry. The name of one patient who said she felt ill from it was Mrs. Gray, of Plaistow.

Justice FRY: You have said if people were well it would make them ill, and you are asked to name a single person who, being well, was made ill?—I cannot.

Cross-examination continued: I can name one person who, being ill, was made worse—namely, Mr. Gray; but I cannot name any other.

Re-examined by Mr. KAY: My wife was well at the time she was made sick; but she is rather a delicate person.

THURSDAY, NOV. 15.

Mr. *George Canning Edwards*, examined by Mr. ASTON.

I reside in the Romford Road, Stratford, about a mile from the gas-works, and have lived there about ten years. During that time I have frequently noticed the prevalence of a very noxious smell. I first noticed it within the last three or four years. The smell is a very disgusting one, and has made me feel very sick. I do not know that the smell may be compared with that which arises from rotten eggs, but it is very offensive. I cannot, from my own knowledge, say whence it arises. I think I first noticed the smell frequently in 1875. I find the smell prevails when the wind is south-west. The smell has not produced sickness upon me, but it has had that effect on my sisters.

By the COURT: I do not know that they have been actually sick, but they have had a feeling of sickness.

Examination continued: I called several times at the town-hall to complain of it about two years ago.

Cross-examined by Mr. SMITH: I first complained of it in 1875. I have not lived in the same house ten years, but I have lived in the same road ten years. I may have experienced the smell when I went into the new house. I changed my residence in 1873. To the best of my recollection, I did not experience this smell when I first went into my new house. It might be six months after I went into my new house that I experienced the smell, but I cannot say. The smell is occasional, but mostly when the wind is south-westerly. I do not think I smell it when the wind is in any other direction. We experience it in the morning before we get up; it comes under the window-sills and down the chimneys. We sometimes experience it in the evening. In fact, I have no doubt about it.

By the COURT: When the wind has been in the south-west within the last ten days we have smelt it. We experience it about once a week or once in ten days. It continues for some time, until I leave for business. When I wake in the morning I find the smell in the house, and sometimes it continues until I leave, and sometimes passes off.

Mr. BENJAMIN said he did not think he ought to cause the relators to go further into this class of evidence, because the company admitted there might be an intermittent nuisance, but not a continuous one.

Justice FRY said it appeared to him an important ingredient in the informants case to show how often it had happened.

Mr. BENJAMIN was willing to take the evidence of the last witness, who said it was once in a week or once in ten days. In the morning when he got up he found the odour in his house, and it passed off.

Justice FRY said he was impressed with Mrs. Scott's evidence on the previous day.

Mr. BENJAMIN admitted that there was an intermittent nuisance.

Mr. KAY said if the other side admitted upon that evidence, without more, that the relators had made a case for an injunction against the company, that was enough.

Justice FRY said Mr. Kay would be at liberty to call further evidence if necessary after the company's evidence in chief.

Mr. KAY said he would not at present call further evidence to prove the existence of the nuisance.

Justice FRY said he should like evidence as to the character of the neighbourhood further east.

Sir *Edmund Hay Currie*, examined by Mr. KAY.

I know the neighbourhood of the Bromley Gas-Works pretty well. My business is situated within a few hundred yards of the gas-works, and my residence is close to my business premises. The neighbourhood about my residence to the west is occupied by the poorer classes. From having lived in the neighbourhood for 23 years, I know its character on the other side. I have often passed through it. There is a large quantity of new property now built at Upton, and all around West Ham Park. The class of houses there is of a better class than we have at Bromley.

By the COURT: There are a good many houses about Plaistow of a smaller class.

Examination continued: I know Plaistow. Years ago there used to be a good many good families living there. Smaller houses have been built upon gardens. Building in the neighbourhood is increasing, and the character of the houses now built is the usual small house property that you see all round London. I know Canning Town, and I should think that is as poor as any part can be. There is an immense property existing between where I live and Bow. There is a dense population all round there. The part where there are some residential houses is about West Ham Park and Plaistow, and down the Romford Road.

By the COURT: Upton and Romford Road are the best parts of them.

Cross-examined by Mr. BENJAMIN: The buildings that have been put up in that neighbourhood have been mostly built within the last few years. Prior to 1869 there was a very large amount of residential property about there. The population has since increased. The larger properties have been cut up, and the grounds are now occupied by a considerable population.

Mr. *A. G. Vernon Harcourt*, examined by Mr. KAY.

I am one of the Gas Referees, and have been so five years. I have made myself acquainted with the mode of manufacturing gas in all the gas-works with which we are concerned, which are the principal companies of London. There are eleven separate works under our inspection. Under the 52nd section of the Act, the Referees are required to fix the maximum of

purity which can be attained without occasioning a nuisance to the neighbourhood in which the works are situated. To the best of our judgment we have fixed the maximum which the defendant company ought to attain, keeping that condition in view. The maximum varies during summer and winter, and varies also in urban and suburban works, between 15 grains of sulphur per 100 cubic feet of gas in summer, and 20 grains in winter, in one case, in the other 20 and 25 grains. It is required by the Act of Parliament that sulphuretted hydrogen should be wholly excluded. There is a difference between the summer and winter maximum, because the amount of gas to be supplied in summer and winter varies considerably, while the means of purifying the gas remain the same. In the exercise of our duty of fixing a maximum which should be attained without creating a nuisance, we have taken pains to satisfy ourselves that the maximum we have fixed could be so attained. Amongst other things we have investigated the mode of preventing a nuisance. We have visited those works from the neighbourhood of which complaints of nuisance have come, to form the best judgment we could as to the means that could be adopted to prevent nuisance, and that includes these works. We have under our inspection the works at Beckton, Bromley, St. Pancras, King's Cross, Bow Common, Kensal Green, Fulham, and Pimlico, being eight. The same process of purifying the gas is substantially used in each of them, but the precautions taken to prevent a nuisance are not the same in all cases. The nuisance is most likely to arise, in my judgment, in the process of emptying the lime purifiers, and getting rid of the refuse lime. I have never yet seen lime taken out of a purifier which would not have some smell if you were close to it. When taken out of the purifiers not in the condition of carbonate of lime, it is liable to be much more offensive. The reason for that, in my judgment, is that it contains different substances. Carbonate of lime itself is absolutely inoffensive. The principal substance which makes lime offensive is sulphocarbonate of calcium. All lime exposed to the air gives off only a small part of the sulphur it contains. The chief action of the air is not to set free, but to change the sulphur compounds. I have observed the precautions taken to prevent the emanation of these noxious vapours, especially at Fulham. The precautions are that the lime is, as far as possible, kept covered over from the time of raising the lid of the purifier to the time of removing the refuse lime to the barge; and also, when the lime is in a dusty condition it is watered so as to lay the dust, and they draw air through the lime in the purifier in order to make the lime less offensive when it is removed. The passage of air through the lime draws out the foul gas, which, being removed, makes it less offensive. Oxide of iron is used to absorb sulphuretted hydrogen. The air, I think, does not create a nuisance. There is a small amount of smell. The oxide of iron takes out the worst part, which would be sulphuretted hydrogen. I do not think the process at Fulham is costly. There is an amount of additional trouble, and I ought to name that there is some difficulty in avoiding the risk of an explosion. That is in the operation of drawing air through the purifiers. I should say that that danger could be avoided. I think the plan adopted at Fulham is the best. I do not know that it could be improved upon. It might be possible to take the lime out of the purifiers in close tanks or carts without allowing it to be exposed to the action of the air, if it were not a question of trouble or expense; it is simply a question of the "worth while." In May, 1877, I gave evidence before a parliamentary committee, with reference to the Bill promoted by the defendant company, as to the condition of things at the Bromley works. The process used at the works at Bromley, for emptying the lime purifiers which were offensive, was that the lime was shifted into wheelbarrows which were run on planks, and so transferred a short distance, where the lime was spread on the land, and then, I think, covered with lime which had been exposed to the air. The only precaution I remember was that some damped breeze was thrown over the surface of the layer of lime when it was first exposed to the air. It was done in the open air. The precaution of doing it in a closed shed might have been some advantage. It would arrest the lateral diffusion of the smell. In the works at Pimlico it is done under cover, and also in the works of the South Metropolitan Company, and at one of the works of the Commercial Gas Company. I formed the opinion at Pimlico that the shed was a benefit.

By the COURT: I cannot say how far the dust would be carried by a strong wind.

Examination continued: I was desired by the chairman of the Parliamentary Committee to give evidence, not in support of the Bill or against it, but because he thought it would, perhaps, shorten the inquiry by my evidence throwing some light upon the subject. I do not volunteer evidence here, but I come here upon a subpœna. The Referees wrote a letter to the secretary of the defendant company, and I sent a copy of that letter to the Board of Trade in January, 1877. Having my attention called to that, I adhere to it. We say that no precautions of any kind were taken to prevent the diffusion of the offensive smell, except sprinkling a little wet coal or ash dust on the foul lime, which did little or no good, and that is accurate, according to the best of my recollection. When I gave evidence before the committee, I stated that I knew of no reason, besides the expense, why sheds should not be erected over the purifiers. I know the process of Mr. Evans, who was formerly the engineer and is now a director of the defendant company, for emptying purifiers. That is the process of ventilation. That process has not been abandoned to my knowledge. It was in use at the Fulham works when I last visited there, which may have been in May of this year. It has been in use at those works I think about a year and a half. An accident by explosion has happened at the Bromley works, but not at Fulham. It was used at the Bromley works for some time.

Mr. BENJAMIN: It had to be abandoned, because the workmen would not stand it.

Examination continued: I do not think it has been in use at Bromley since January. I can see no reason why what is done at Fulham should not be done successfully at Bromley. The works are about on the same scale. The only difference I know of is that the Fulham works are nearer to houses, from which complaints would come.

By the COURT: There have been complaints at Fulham, but I consider the condition of things there is better than at Bromley.

Examination continued: I think I heard the whole of the evidence before the committee of the House of Commons. I heard the evidence as to the existence of a nuisance at Bromley.

Justice FRY asked whether the relators wanted to show that evidence of nuisance was tendered by the defendants.

Mr. KAY replied that they proved the nuisance, but did not prove they were unable to remove it.

Mr. BENJAMIN thought it was rather an extraordinary mode of proceeding, because the witness could not know what was in the minds of the committee.

Justice FRY observed that he might know what the chairman said.

Mr. BENJAMIN admitted that, but he could not know what the other members thought.

Examination continued: I heard what the chairman said on that occasion. He said that the committee had decided to declare that the preamble of the Bill was not proved.

Justice FRY thought that was more a matter of cross-examination.

Cross-examined by Mr. BENJAMIN: We allow a greater amount of impurity in urban than in suburban districts, because, when works are at a distance from houses, it is possible to use lime more freely than when houses are in the immediate neighbourhood. We consider the purification of the gas is a difficult matter, though not impossible for the manager of the works, and the difficulty is greater when the works have houses near them than when they are out in the country as it were. In consequence of that we have given more margin.

By the COURT: My own opinion is that it is practicable at all the works to purify the gas to the maximum we name without causing nuisance.

Cross-examination continued: My knowledge of the subject is derived chiefly from what I have seen on visiting gas-works. I have not had the command of gas-works. My only acquaintance is from making experiments at gas-works, and from what I have seen in the works I have visited. We have thought it fair to allow a greater margin of impurity in the case of urban works, in consequence of the difficulty there is in purifying. The process is substantially the same in all the works. At Fulham, after the gas has passed through the sulphide of calcium, it is passed through oxide of iron, for the purpose of removing the sulphuretted hydrogen from it. At Bromley, I was given to understand that air was passed through the refuse lime, and subsequently purified by being passed through oxide of iron. At Fulham there were several precautions taken besides that. The refuse lime was kept under cover, as far as possible, during the operation of removal, and also after it had left the purifier, and the trucks in which it was conveyed to the edge of the river were also covered, and also when it was discharged into the barges. At the time I saw the lime being put on the ground at the Bromley works it was in a dry condition, some damp breeze was strewn over it, but not sufficient. I would apply water directly by sprinkling from a hose. They put, in my opinion, an insufficient quantity of damp breeze upon the surface of the lime. If the surface of the lime had been at once watered, I think it would have gone a long way to prevent the spreading of the smell.

By the COURT: When we visited Bromley at the end of 1875 or the beginning of 1876, we had given notice of our intention to come.

Cross-examination continued: I believe that the chief spreading of the smell depends upon the mechanical transportation of the very finely-divided substances by the wind. I adhere to the evidence which I gave before the House of Commons committee when I say that the manufacture of gas cannot be conducted without the production of a certain amount of unpleasant smell. The expense and trouble only are the matters in question to keep down the nuisance. I have made experiments in the laboratory. In the laboratory I did succeed in eliminating from the gas the sulphurous compounds by a process which I do not think is practicable in gas-works. I have reduced the amount of sulphur in gas to less than one grain in 100 cubic feet in the laboratory. I know no more efficient mode of purifying gas than the company now adopt, when the process is worked at its best. I think it would be better to keep the contents of the sulphide of calcium purifiers more covered from the air. I believe that combination, with the precautions I have named, would be sufficient; but I do not despair of finding others. Putting purifiers under cover has been tried in many gas-works, and I think to the other precautions that ought to be added.

By the COURT: I suggest three things—the abundant use of water to lay the dust; keeping the whole of the lime under cover, from the time it comes out of the purifiers to the time it goes away on the barge, as far as possible; and ventilation, and purification of the ventilating air.

Mr. BENJAMIN said the quantity of spent lime produced was immense; but they covered it with a layer of damp breeze. He was told it would cover a number of acres 9 feet deep.

Cross-examination continued: I am aware that the company at Beckton tried to prevent the smell by putting sheds over their purifiers; but a roof over them will not prevent the access of wind. I do not remember having seen their purifiers under a shed with sides and a roof. I have not heard of these impurities in the air being injurious to vegetation around. I do not know that there are market gardens all round the works at Bromley, nor whether there are vegetables and flowers raised within the grounds of the gas-works.

Justice FRY inquired how that would help the company.

Mr. BENJAMIN replied that if vegetation flourished, he could not think it would be very injurious to health.

Mr. KAY observed he understood the nuisance was admitted.

Mr. BENJAMIN replied that they did not admit the injury to health; on the contrary, they denied it.

Cross-examination continued: I do not know whether sulphur compounds are given off by tar distillation in the last stage of the process. I have been at tar-works, and have seen the distillation going on. In distilling anthracene, sulphuretted hydrogen is not given out within my knowledge.

Re-examined by Mr. KAY: I have seen the troughs intended for oxide of iron at the Bromley works. They were not in use, I think, when I was there. I think the explosion had occurred a short time before, and in consequence the process was disused at that time. I do not think I said the process was abandoned. I observed the mode in which the gas lime was endeavoured to be made innocuous. It was covered over with some deposit which had been thoroughly acted upon and rendered inoffensive by the air. The breeze was spread in the purifying-box. I do not consider that enough was used, because as soon as the emptying proceeded the surface was broken by the shovels of the workmen. I do not think that at all sufficient for the purpose. No other precautions were taken that I observed. I think the chief part of the nuisance arose during the actual emptying of the box. Such a thickness as 9 feet of foul lime could not lie on the earth without creating emanations, but it very soon ceases to be offensive. Whilst the surface is being acted upon, there is some unpleasant smell. I think two or three days are enough to get rid of the offensiveness of the spent lime. I saw no barges at Bromley with foul lime in them.

Mr. KAY said he did not propose to trouble the Court with any more evidence at this stage of the case.

Justice FRY inquired whether Mr. Aston desired to address him upon the evidence.

Mr. ASTON said he did not think he could do so with advantage.

Mr. DAVEY (in the absence of Mr. Benjamin) opened the defence, saying the case shortly was that the company were not only authorized, but were bound, within the limits of their district, to supply gas; and not only so, but to supply it of a certain degree of purity, according to the orders of the Referees, not containing at present more than 20 grains of sulphur compounds per 100 feet. The Act of Parliament put upon the company penalties if they exceeded the maximum fixed by the Referees, and, therefore, he contended that the company were precisely in the same position as if they were ordered by Act of Parliament to supply gas, within the limits of their district, of a certain degree of purity.

Justice FRY inquired whether Mr. Davey would say that a *mandamus* would lie to compel the company to supply.

Mr. DAVEY said it was not necessary for him to put his case so high as that, although he thought so, because, where there was an order that the Referees should fix the maximum, and that the company should obey the orders of the Referees, subject to the payment of a penalty, the company

were in the same position as if the Act itself had fixed the degree of purity.

Justice FRY: You say a *mandamus* would lie to compel you to supply gas.

Mr. DAVEY thought so, and would call attention to the sections of the Act. It was said on the other side that the company were not bound to make the gas at Bromley. The company, however, had no powers except what the statute gave. They could not erect gas-works except where their statutory powers permitted them. The works were erected under an Act of Parliament, which recited that the place was well adapted for the purpose. They were a long way from the district which the company supplied. All the gas had to be conveyed in mains at a very considerable expense, and it could only mean that the place was well adapted in the sense of being a place where gas-works might properly be erected.

Justice FRY: You say the company are under three obligations—first, an obligation to supply gas; secondly, to supply gas of a given purity; and, thirdly, to make that gas at Bromley.

Mr. DAVEY said they had no other place than at Bromley at which to make it. His lordship was aware that gas of the degree of purity required could not be produced without lime purification—that oxide of iron would not do. The company were, therefore, obliged by the statutory obligations put upon them to use lime, because there were no other means known to scientific men, or practical gas engineers, by which the sulphur compounds could be brought down to that maximum. That being so, the only question was whether the company used the best appliances which were known to gas manufacturers. He could conceive it possible that some gentlemen, by trying experiments in their laboratories, might come and say they could tell the company a very excellent way; but a gas company could only be bound to use the best known appliances upon a manufacturing scale.

Justice FRY said he did not know that the company were not bound to try experiments if by so doing they could prevent a nuisance.

Mr. DAVEY said they were not bound to try every experiment that a person might suggest, and so possibly put their shareholders to an enormous and unnecessary expense.

Justice FRY said they were bound to act as reasonable men.

Mr. DAVEY would admit that. They were, no doubt, bound to use all reasonable means for making gas of the required purity. The evidence he should offer would be for the purpose of showing that they did use such means as were known to gas manufacturers. They had even made experiments which had been very costly, but had proved unsuccessful, and they were doing all they could.

Justice FRY remarked that that line of argument went to justify the nuisance.

Mr. DAVEY understood Mr. Benjamin to have admitted that the company did occasionally do that which was a nuisance when the lime purifiers were being discharged. That there was a smell they could not deny. Mrs. Scott, who gave her evidence very fairly and well, no doubt had stated the truth that it was so sometimes. She said that when she had a garden party they were driven into the house; but he thought there must be some mistake about that.

Justice FRY said the company had a large area of foul lime, which was only protected from the atmosphere by a thin covering. What could be more likely than that, when that cover was disturbed, there would be a foul smell.

Mr. DAVEY said the evidence showed that the smell was intermittent. If it arose from lime, which, according to Mr. Vernon Harcourt's evidence, was spread over the ground, it would be continuous.

Justice FRY said no; because if a man took a shovel and dug up the surface, the wind happening to be south-west would carry the smell to Mrs. Scott's house.

Mr. DAVEY said Mr. Wright would give evidence of the operations of the company, how they were conducted, and at what time of the day.

Justice FRY said it would appear to be contended that if the operations could not, by taking reasonable care, be performed without creating a nuisance, the company were justified.

Mr. DAVEY said he relied on the law as stated in the case of *The Attorney-General v. The Conservators of the River Thames*, before Vice-Chancellor Wood.

Justice FRY remarked that there was an earlier case, *Rex v. Pease*.

Mr. DAVEY said supposing he proved that the nuisance was necessary, then he should say it was for the other side to prove that they carried on their business negligently. He then referred to the Act of 1854, incorporating the Imperial Company, section 6 of which stated the objects and purposes for which the Act should be put in force; and the 7th section stated the limits within which the company should have power to put those purposes of the Act in force. That he read as a direction to the company to supply gas within the limits when required, but, of course, they could not compel people to take gas from them if they did not require it. The next Act was the Metropolis Gas Act of 1860, which defined the districts of the Metropolitan Gas Companies *inter se*, and he thought the fair reading of it showed that there was intended to be imposed by the Legislature an obligation on the different companies to supply gas within the limits allotted to them.

Justice FRY said it was a private arrangement sanctioned by Act of Parliament.

Mr. DAVEY remarked that certain public duties were imposed on the company.

Justice FRY said if the company supplied gas they were bound to do such and such things, but he did not see the obligation to supply gas.

Mr. DAVEY said if any shopkeeper had asked the company to supply gas, and they had refused, that shopkeeper might have obtained a *mandamus* to compel the company to do so.

Justice FRY said undoubtedly the Legislature thought that the company would supply, and they trusted to their self-interest; but that was different from creating a legal obligation that they should supply.

Mr. DAVEY said, reading the preamble and section 6, together with section 14, the true construction of the Act was that the company, as long as they carried on their business, could be compelled to supply.

Justice FRY asked whether Mr. Davey contended that the company, after the Act of 1854, could not be wound up.

Mr. DAVEY did not know that he need put it so high as that.

Justice FRY said, if they were bound to do something, they were bound to be existing in order to do it. The company must have immortality.

Mr. DAVEY said it might be that the company would subject themselves to certain liabilities for not fulfilling their statutory obligations. If the company disappeared, there would be nothing to enforce the liability against; but there was a positive obligation on them to supply gas as long as they were a company. What the consequences might be if they brought themselves within the purview of the Winding-up Act he did not know.

Justice FRY asked whether, after the Act of 1854 was passed, they could have folded their arms and said they would do nothing more.

Mr. DAVEY said they could have been compelled by *mandamus* to manufacture and supply gas. He thought the words, "every gas company from time to time supplying gas," looking at the purpose and object of the Act, which was to secure a supply of gas within each district by each company in the most convenient way, and looking at the monopoly clause, and looking at the way in which the power of altering the districts assigned by the Act was given to the Secretary of State, no other conclusion could be come to than that the company were under a positive obligation to supply gas within their district.

Justice FRY: I pointed out that by section 6 provision was made for letting in other companies.

Mr. DAVEY said they would come within the purview of the Act, and would be in the same position as if they had been a company to whom a district had been assigned. The words were that every company who for the time being had charge of a district were bound to supply gas. Sections 17, 19, 22, 24, 30, 42, 45, and others, showed that the companies were compelled to light all public lamps, if required so to do by the local authorities. There was no limit to that obligation.

Justice FRY said it was quite evident the Legislature was trusting to the self-interest of the companies in thinking that they would enter into contracts, but the companies could not be bound to contract.

Mr. DAVEY said no doubt that was so.

Justice FRY desired to call attention to this, that in section 17 the expression was simply "gas company," and the definition was that the expression "gas company" meant any and every company supplying gas.

Mr. DAVEY would ask the Court to read the expression, a company supplying gas within the limits, as meaning a company to whom a district was assigned by the Act, or might be assigned under the powers of the Act, for supplying gas. Then in the Gas-Works Clauses Act of 1847, which was incorporated with the last Act he had referred to, the only section of any importance was section 49, and that, in fact, was not very material.

Justice FRY asked whether there was anything that referred to nuisances.

Mr. DAVEY replied not until the Act of 1869.

Justice FRY reminded Mr. Davey that there was an amending Gas-Works Clauses Act of 1871.

Mr. DAVEY said section 11 of that Act was the only one of any importance, but that was after the Act of 1869, and therefore would not apply. The preamble of the Act of 1869 recited the Act of 1854, and later the Act of 1866, which was merely for the purpose of raising capital. Then there was a recital of what the Legislature thought was the result of the Metropolis Gas Act of 1860, because it said that whereas under the provisions of that Act the company were placed under an obligation to supply with gas the district thereby confided to them. It also stated that the land was well adapted for the purpose of the company's undertaking, and it was expedient they should be authorized to purchase the same, although situated beyond the limits which they were authorized to supply with gas.

Justice FRY pointed out that the whole power of the company to come to Bromley was in the Act of 1869.

Mr. DAVEY said that by that Act they were authorized to purchase the land necessary for their works, as much as 150 acres, part of which was still let out as a market garden.

Justice FRY said he thought the recital that the company were placed under an obligation to supply with gas the district confided to them was very strong in favour of Mr. Davey's argument.

Mr. DAVEY then read several clauses of the Act, and stated the effect of others, directing special attention to clause 44, as to the appointment of Referees, and to clause 52 as to the maximum of purity; and also section 88 as to the disposal of their refuse. Mr. Kay had said the company could not be required by the Referees to commit a nuisance. The Referees might be of opinion that the company could make gas with not more than 20 grains of sulphur impurity without occasioning a nuisance, and that was an element for the Referees to consider. Suppose they made a mistake, and ordered the company to supply gas of a purity which they could not produce without committing a nuisance, nevertheless the company must obey the orders of the Referees. Section 88, he contended, referred to the manufacture and conversion of the residual products from the refuse materials of the manufacture of gas; and therefore section 88, so far as regarded the manufacture of gas, did not carry the matter any farther. If, without that section, they had a good defence to an information or indictment for a nuisance, that section did not take away their defence. Even if that were not so, the section could not mean more than that it should not exempt them from being liable to an indictment or information, leaving to the company any defence they might have had before.

Justice FRY said it left the question exactly where it was, because it was only such information as they might have been liable to.

Mr. DAVEY said those were all the statutory enactments which it was useful to call attention to; and reading these Acts together he submitted he had made out his case, that within the district assigned, or which might, from time to time, be assigned to the company by the Act of 1860, they were under a positive obligation to supply gas to any owners or occupiers of any house.

Justice FRY again said that he did not see the obligation to make gas at Bromley.

Mr. DAVEY said if they were bound to supply gas, and the Act of Parliament said their present works were insufficient to fulfil their obligations, and therefore they ought to be authorized to buy land for the erection of fresh works, and the Act expressly recited that the particular plot of land they had purchased was well adapted for the company's undertaking, and authorized them to erect gas-works for the purpose of fulfilling their statutory obligations, and they had no power to purchase a single rood of land without statutory powers—he thought that made out his case.

Justice FRY asked whether the company had not power to buy land within their own district by agreement.

Mr. DAVEY did not think so.

Justice FRY did not see that the permission to buy land at Bromley created an obligation to supply gas.

Mr. DAVEY said it was sufficient for his case to show that he had authority, as was shown in the case of the Thames Conservators.

Justice FRY said that was a different case. There they were a public body, entrusted with public powers for public purposes; whereas the defendant company were a trading body.

Mr. DAVEY said if he was right in saying that the company were charged with the duty, under an absolute obligation, to supply what would now be considered a necessity of life, within a certain district, and having a monopoly of supply within that district, whether they were in terms a public body or a trading company, did not the same observation apply? Because they were executing a public work for a public purpose, the Legislature having given them a monopoly for that purpose. He contended it was an indirect obligation; that they were ordered to supply gas within their district, and their statutory powers enabled them to use the land at Bromley for the purpose of satisfying that statutory obligation.

Justice FRY said for aught he knew they might have obtained land within their own district sufficient for their purpose.

Mr. DAVEY said the Act recited that the site was well adapted for the purposes, and that was the basis upon which the Act proceeded. In *Rex v. Pease* there was no obligation.

Justice FRY said there was an authority, and they could not exercise the authority without creating a nuisance.

Mr. DAVEY said the argument would come to this—that the company

must go and commit a nuisance elsewhere than at West Ham, where the Legislature had allowed them to go.

Justice FRY said the company admitted they were bound to commit a nuisance somewhere, and they had authority to commit it at Bromley.

Mr. ASTON: The radius might vary within which it would be a nuisance.

Mr. DAVEY understood Mr. Benjamin only admitted it was what in law would be a nuisance of an intermittent character. He then called attention to *Rex v. Pease*, 4 Barnell and Adolphus. He said the Legislature must be taken to have known that gas of the required purity could not be made without committing a nuisance.

Justice FRY said that section 62 of the Act of 1869 was directly against that.

Mr. DAVEY said the case of the defendants was that the Referees had made a blunder.

Justice FRY said he followed that argument, but they could not persuade Parliament that that was so.

Mr. DAVEY said they asked to be relieved from being at the mercy of the Referees.

Justice FRY said he did not feel any doubt on the proposition of law, that if the company were under an obligation to do something which they could not do without committing a nuisance, they were justified in so doing.

Mr. ASTON said he could not dispute that, but they must show the obligation.

Mr. DAVEY then referred to the cases of *The Mersey Dock Trustees v. Gibbs*; *The Attorney-General v. The Thames Conservators*; *The Attorney-General v. Leeds*, and *The Attorney-General v. Cockermouth*, and said he would call the engineer who had the management of the works, and also independent scientific men, and he hoped to satisfy his lordship that the company were using the best practicable means for getting rid of what undoubtedly was a serious nuisance if it went to the extent that the other side said, but which the company denied.

Justice FRY asked whether he admitted that there was that which in law would amount to a public nuisance.

Mr. DAVEY replied that he did, but that it was intermittent. He had about 40 witnesses who lived near the place, and who said that it was not a nuisance, but he could not call them after the evidence which had been given.

Justice FRY said the evidence of Mrs. Scott was very clear upon the nuisance, and she proved it was intolerable.

Mr. DAVEY said the company had gone to Parliament to be relieved from the 20-grain limit, and it appeared to the directors to be a little inconsistent to contend that it was not a nuisance.

Justice FRY said the real issue he had to try was whether the company could perform the obligations of the Act without committing a nuisance.

Mr. DAVEY said that was so.

Witnesses were then called on behalf of the company. A report of their evidence will appear in the next number of the JOURNAL.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

METROPOLITAN BOARD OF WORKS.

A Special Meeting of the Board was held on Wednesday last—Sir J. M'G. HOGG in the chair—when the following report of the Works and General Purposes Committee was presented:—

Spring Gardens, Nov. 12, 1877.

Your committee, in pursuance of the instruction to them to report forthwith their proceedings on the Water Supply to the Metropolis, beg to report that they have proceeded on the reference contained in the following resolution, passed by the Board on the 23rd of February last—"That, in the opinion of the Board, the time has arrived when effect should be given to the report of the Royal Commission on Water Supply, so far as the same refers to the water supply for the Metropolis being placed under the control of a responsible public body; and that the subject be referred back to the committee, with instructions to prepare a Bill empowering the Board to take under their control the water supply of the Metropolis, and to purchase the interests of the existing companies and extend existing works, and that the committee be authorized to confer with Her Majesty's Government, and to report the draft Bill to the Board."

In connection with the above reference, your committee have also had before them the report, prepared in pursuance of the resolution of the Board of the 23rd of March last by the engineer, in conjunction with Mr. F. J. Bramwell and Mr. Edward Easton, upon the best means of providing an efficient supply of water for extinguishing fires and for other purposes.

Your committee may premise that they felt it desirable, with a view to the fullest consideration being accorded to the numerous and varied details involved in this question, to appoint a sub-committee to inquire into the whole subject, and to report to them as to the heads and principles of the Bill which the Board, by its resolution above quoted, has authorized your committee to prepare. In their earlier proceedings your committee dealt only with the questions comprised in the original reference—namely, the purchase of the interests of the existing companies, and the extension of existing works, but, upon the subsequent reference of the joint report of the engineers, they included that also in their deliberations. The report in question was submitted by your committee to the Board on the 10th of August last, and, upon their recommendation, was printed and circulated. It may be sufficient, therefore, shortly to state that the proposition which it contains is to provide, by means of wells and borings in the great water-bearing strata in the country districts around London, a supply of 16 million gallons per day of pure spring water for potable, culinary, and fire-extinguishing purposes. The details of the construction of the proposed works, and the estimates of the expense are fully stated in the report, a copy of which is annexed hereto. Your committee, having carefully reviewed the whole question referred to them under the two resolutions of the Board, have arrived at the conclusion that, in order to meet the complaints which are made against the present supply of water for drinking purposes, and to secure the necessary pressure and quantity for the extinction of fires, it is absolutely essential that there should be an additional and more satisfactory source of supply, which a mere extension of the existing works could not secure, and it appears to them that the project put forth in the report of the engineers is well calculated to effect the desired object. They consider it indispensable that the Board should submit to Parliament a perfect scheme, and they would urge that if it were proposed merely to purchase the existing undertakings, there would still remain the serious question as to the purity of the supply of water for drinking purposes. It would, moreover, be impossible to secure an adequate supply for the extinction of fires, for the reason that the required pressure, assuming it could be obtained, would result, in all probability, in the destruction of the existing house-fittings, these not being sufficiently strong to bear the pressure necessary for the effective use of fire hydrants. There is another point which has presented itself to your committee in connection with the proposal, and which, in their judgment, considerably enhances the advantages to be derived from its adoption. This relates to the supply of water to the vestries and district boards of the Metropolis for the purpose of road and street watering. Your committee have conferred with the engineers as to the practicability of including in the proposed supply a sufficient quantity of water for this purpose, and it is with great satisfaction that they are enabled to state that those gentlemen, after fully considering the question, have reported that there would be no difficulty in obtaining the required quantity from the proposed new works, and that the result would be a saving, in water and labour, of about £70,000 per annum on the present cost to the parishes.

Entertaining the views above expressed, it became necessary for your committee to consider whether the scheme for the new supply should be included in the Bill for the purchase of the interests of the companies, or should form the subject of a separate Bill, and having conferred with the solicitor and the parliamentary adviser of the Board, and also with counsel, it appeared to your committee that the better course would be to prepare a separate Bill for the new supply. Instructions to this effect have accordingly been given to the parliamentary draftsman; but it must nevertheless be distinctly understood that the two proposals are integral parts of one great measure, the object of which is to secure a better and more efficient supply of water, and that their severance into two Bills is to be considered more especially as a matter of parliamentary procedure, and as being more in accordance with the rules of the House of Commons. It is proposed that the Purchase Bill should be introduced as a public measure, but that the Bill to authorize the new supply, which will contain provisions for the compulsory purchase of certain lands, should be promoted as a private Bill.

With regard to the provisions of the Bill for the purchase of the interests of the companies, your committee are of opinion that it is desirable, in the first instance, that a Bill should be introduced simply providing for the compulsory purchase of the companies interests, for such a sum as may be agreed upon, or, in default of agreement, for such a sum as may be awarded by arbitration, pursuant to the provisions of the Lands Clauses Consolidation Acts; and that the Board should be authorized to stand in the position of the companies, both within and without the metropolitan area, as the undertakings shall be from time to time acquired, until the whole shall have been purchased. That, subsequently, a Bill should be submitted to Parliament for remedying the anomalies which now exist in the rating in respect of water supply, and for otherwise more effectually regulating the supply to the Metropolis. Your committee have directed the preparation of the Purchase Bill upon the principle above suggested, and they recommend this view for approval and adoption by the Board.

Your committee have given directions, as already stated, for the preparation of the Bill to authorize the new supply of water, and for including in such Bill a power to supply local authorities with water for road-watering and such other purposes as may be to the public advantage. To this your committee have also to recommend the Board to give their sanction.

Your committee deem it unnecessary to enter into the question of the ultimate saving which will result from acquiring the whole of the water-works of the Metropolis—a saving which there will obviously be, in the fact that capital will be raised at 3¼ per cent., and that the Board will have every reason to economize capital outlay. But as regards the new works, they desire to draw attention to the fact, as appears from the estimates furnished by the engineers, that by the execution of these works, instead of the enlargement of the existing undertakings, which will otherwise become necessary, an annual saving of £112,250 will be effected.

The engineers, in accordance with the directions of your committee, have made such surveys as were necessary for the preparation of the *Gazette* notices, and your committee, having placed before the Board the leading features of the proposed Bills, have now to submit the forms of such notices, and to recommend that the solicitor be instructed to take the necessary steps for publishing the same.

[The report of the engineers, referred to above, appeared in the JOURNAL of Aug. 14 last, page 258.]

Mr. ROCHE, in moving the adoption of the report, said that no question which had ever been taken into consideration by the Board was of more importance as regarded the health of the enormous population of the Metropolis, which now exceeded 3¼ millions, or as affecting the protection of its vast property, but it was a subject that was surrounded with difficulties when legislation was attempted in respect to it. On the 22nd of February last the Board adopted a resolution affirming the principle that the water supply of London ought not any longer to remain in the hands of private companies, and they had referred the subject to the Works and General Purposes Committee to prepare a Bill for the purpose of giving effect to that resolution. It would therefore be a useless waste of time on his part to enter upon any arguments or to refer to any evidence whatever in support of that main proposition. But when they went to Parliament what would they go for? It was, first of all, admitted upon all hands that they must go to purchase the water companies, in order that they might give effect to the various recommendations of Royal Commissioners, Rivers Pollution Commissioners, and the Committee of the House of Commons on the Metropolitan Fire Brigade. It was the duty of the Board to go to Parliament next session, but in approaching Parliament what must they do? Were there any defects in the present system of supplying water? There were certain main and recognized defects with which the Board, if they introduced a Bill to purchase the companies, must be prepared to grapple in all their magnitude, and they would have to submit to Parliament some remedy for those defects. The Board appreciated the position in which they were placed, and understood its magnitude, and were not afraid of the expense. Now, what were the main defects that at present existed? One was to be found in the use of cisterns, which made the water worse than when it first entered them. Another was that the supply was not of that pure, wholesome quality which the inhabitants had a right to expect should be brought to their doors. A third, which had been admitted over and over again, and which the Board themselves had admitted, and said they were prepared to remedy, was the want of a constant supply, which Parliament had several times said was necessary. A fourth was the insufficiency of the present supply for the extinction of fires, and the protection of the life and vast wealth of the Metropolis. He did not know whether any of the members would be prepared to deny that those were the main defects of the existing system. Some question might possibly arise as to the quality of the water, but he thought that with reference to the questions of the constant supply, and insufficiency of supply for the extinction of fires, there would be no difference of opinion. These defects being admitted, and it being the intention of the Board to apply to Parliament to place the supply entirely in their own hands, they must, in order to do their duty to those whom they represented, be prepared to lay before Parliament some scheme for remedying them. He submitted that the Board would be wanting in all that Parliament would require from a municipal body, if they hesitated to take such steps as would give to the ratepayers that which they had a right to expect when the supply passed into the hands of the Board. The question was referred to a sub-committee, in order that a Bill might be prepared. At that time the Select Committee of the House of Commons on the Fire Brigade question were sitting, and, of course, the Board were not then aware what the report of that committee would be; but in July last that report was presented to the Board, laid upon the table, and referred to the sub-committee. He thought it necessary to refer to that report, because its language was so clear, and the resolutions contained in it were of such a character, that it scarcely left any option to the Board. The committee reported that the present companies were mere purveyors of water for ordinary consumption, and in carrying out that object they were authorized to consider solely the convenience of their customers and the profits of their shareholders. The result was that in laying down their mains they had neglected the three chief conditions which would ensure a proper supply for the extinction of fires—namely, constancy of supply, high pressure, and large mains. That was the finding of the Fire Brigade Committee, and he did not think any member of the Board would dispute that the extinction of fires had never been considered by the companies in providing for the domestic and manufacturing consumption. They had not been bound to take the matter into their consideration, and certainly they had not done so. The Fire Brigade Committee also said that for the purpose of extinguishing fires it was of great importance to have a constant supply, without having to wait for a turncock. Under the intermittent system it was useless to have access to a main unless the water happened to be turned on at the time, and before a turncock arrived the fire might advance beyond control. It was indisputable that there was an absolute necessity for a constant supply throughout the Metropolis, in order that at any moment a quantity of water might be obtained which the experts in such matters said was essential for overcoming fires immediately they broke out. The second point to which the committee attached primary importance was that of pressure, as determining the level to which the water could be raised. At the present time the companies were under no obligation to supply water at the pressure which was absolutely essential for sending up a jet to such a height as was required in extinguishing a fire. Similar observations were made about the size of the mains, the dimensions of the existing ones being fixed solely with a view to the demands made upon the companies by the consumers. At the present time there

were many warehouses by the river side which were supplied at a low pressure. The Fire Brigade Committee next proceeded to consider what were the remedies to be applied, and the general result of the evidence given before them was that, before a system of hydrants could be relied upon as a substitute for fire-engines, there must be a constant supply, high pressure, and mains of sufficient diameter. Now, that was the evidence which the members of the Metropolitan Board gave before the Fire Brigade Committee. The Board admitted all the defects, and had often stated to the committee what they considered was the remedy. It was well known to the Board that they had consistently, and he would say persistently, declined to put the ratepayers to the enormous expense of fixing hydrants throughout the Metropolis for the reasons stated—that there was no constant supply, no sufficient pressure, and the size of the mains was defective. The Fire Brigade Committee proceeded to recommend that a system of hydrants should be established over the whole of London. He believed the Board were quite prepared to endorse that; in fact, after the evidence they had given before the Committee, they could not do otherwise. They further said that the outlay requisite for this purpose would undoubtedly be large; but in their opinion the ratepayers, as householders, would be compensated by increased security for their property. While recommending that the hydrant system should be proceeded with without delay, and extended to the utmost practicable limits. They observed that improvements in the hydrant system, or fire-engine system, could not be worked to the best advantage unless some improvements were effected in the water supply; and the question arose, how far such improvements might be required to be carried out by the several water companies as at present established. The improvements to which they referred were constant supply, increased pressure, and enlargement of mains. They also stated that with respect to the pressure and pipeage, it might be taken that the companies had already acquitted themselves of their statutory duties, the pressure given and the mains used being now sufficient for the domestic supply; but that to make the hydrant system of each water company complete, a very large outlay would be required. New reservoirs would have to be constructed, or additional pumping power for engines; small and thin mains would have to be replaced by large and strong ones, and house-fittings would have to be strengthened. The House of Commons Committee were of opinion that the companies could not be called upon to undertake this expense for the purpose of fire extinction—an expense from which they could derive no profit. They concluded by stating that the water supply could not be made to afford the full measure of protection which the Metropolis should possess against fire, unless it was consolidated in the hands of a single authority conducting the business, not for profit, but for public convenience, and placed under a statutory obligation to provide jets of water sufficient for fire extinction, as well as for the domestic consumption. But they deemed it necessary to observe that, whilst the general result of such a concentration of management, as they had indicated, would be to secure effective means of extinguishing fires, and thereby diminishing loss to the Metropolis, the several changes mentioned in the system of supply would be capable of being carried out at much less expense if there were unity of control, and if public interest were allowed to supersede the various interests of the water companies. These recommendations clearly pointed out the defect which existed with reference to the supply of water, and the remedies that were necessary; and he thought he might say fairly that they pointed to the Metropolitan Board as the public authority who should give the supply of water. They did not use the words "Metropolitan Board," but they referred to a public authority. He apprehended that there was but one municipal authority having control throughout the Metropolis, and who possessed the capability and the power of carrying out a measure of that sort, and that was the Metropolitan Board of Works. These recommendations of the Fire Brigade Committee having been made, and the defects in the system having been admitted, what were the Board to do? They must do one of two things. They must either extend existing works or have some new works, which would be better than the extending of the present works. The committee pointed out that, if the existing works were extended, a large outlay would be required. They said new reservoirs would have to be constructed, additional pumping powers obtained, and small and thin mains replaced by large and strong ones. This could not be done for nothing; but it would have to be done, and the metropolitan public would have to pay for it in some shape or other, and they had to consider which would be the least expensive to the ratepayers. Upon that subject the Board were, of course, to a great extent in the hands of those who advised them. As advised, they were told that the alteration of the old pipeage in order to adapt it to the wants of the Metropolis, in the way which Parliament had pointed out to be necessary, would cost a million of money; and from this he would point out the enormous cost to the City of London of putting down hydrants where they had to adapt them to the old system. A hydrant could now be put down for £9; but under the new system it would cost only £5. A hydrant in the City now cost £9, and the getting into the ground and making the necessary connections would cost £16, making a total of £25, which was an enormous expense contingent on fitting hydrants to the present water supply system. In addition to that, there was the cost of house-fittings. If a constant supply had to be brought into London, all the house-fittings would have to be altered. Regulations had been framed by commissioners appointed by Act of Parliament; and Mr. Muir, one of the engineers of the New River Company, had given evidence before the Fire Brigade Committee that the average cost would be £8 per house, and in many cases it would be £30, £40, or £50; because when the fittings had to be altered, it was not simply the putting in of a large or a small pipe, but there was the disarranging of the houses, cutting through the walls, and other damage, which had afterwards to be repaired. The Act of 1871 was a dead letter as far as the Board were concerned, in consequence of those regulations, and of the enormous expense contingent upon the refitting of the houses. There was a report of the Board upon that subject, and any member could refer to it. The Board had not ventured to carry this system out, because it would have been such an enormous expenditure of money throughout the Metropolis. It would take five millions of money to adapt the present and existing works for the purpose of giving that supply which Parliament said was necessary—one million for pipeage, one million for hydrants, and three millions for cost of house-fittings; and the three millions would have to be wrung out of the pockets of the ratepayers in two years. If the companies were called upon at once to give a constant supply, every one of these householders would have to increase his fittings, and the ratepayers would be called upon to pay three millions. Was anybody prepared to take such a course as that? He (Mr. Roche) took it that this report of the Fire Brigade Committee was an approval of the course taken by the Board in this matter. Then there would be the additional cost of pumping if the companies were to give a constant supply, and at a pressure of 400 feet. That additional pumping was admitted, not by the engineers or advisers of the Metropolitan Board, but by the engineer of the New River Company himself, to be £150,000 a year. If to the interest of five millions at 3½ per cent. be added this £150,000, he thought they would get in round numbers something like £340,000 a year. If the Board went to Parliament with their Purchase Bill alone, Parliament would say, "Do you intend to give that constant supply or this pressure?"—"No; we do not intend to do anything of the sort." "Then why do you come and ask us to give you the supply into your hands?" It would be better for the Board to admit their incompetency than to go to Parliament under such circumstances. Well, after that sum of money had been spent, the interest of it would have to be paid in some way or another by the ratepayers. The companies could, no doubt, undertake to do it themselves—and they might do it—but the Metropolitan Board could do it at 3½ per cent., and the companies would have to pay 6 per cent. But suppose they gave this constant supply of water, they would not give what the Board proposed to give—namely, a pure, potable spring water, clear as crystal, and free from all organic contaminations. Having considered the question as to whether they could extend existing works, the committee came to the conclusion that that was not the right line to take. The simple inconvenience of the ratepayers having to attend to their house-fittings, and the enormous inconvenience and expense, were, of themselves, almost sufficient to prevent any such recommendation. That being so, the committee naturally had to consider whether they were prepared to recommend anything, or whether they should go to Parliament and admit that the question was too great to grapple with, and they came to the conclusion that it was not too great for the Metropolitan Board to undertake. The Board, therefore, pending the reference to the committee, instructed Sir Joseph Bazalgette, Mr. Bramwell, and Mr. Easton to report to the Board with reference to new works. That report was brought up and printed, without the Board pledging themselves in any way to carry it out. It was circulated broadcast, and all the members had a copy, but the Board studiously refrained from giving effect to that report. He thought that the Board exercised sound wisdom and great judgment in coming to that determination. The report had been before the public now for some time. It had been criticized by all the leading journals; he had read those criticisms; and the result, he might fairly say, was that there was a general approval of its principles. It also became the subject of discussion at the British Association meeting at Plymouth—and very properly so—and he believed that it met with the entire approval of the section of eminent men who discussed the question. The report was referred to the Works Committee, who now brought up their recommendation for approval. He did not think it would be necessary to go into the details of the scheme, because the plans were on the table, and it was no longer a report. It had been considered by the committee; the spots where the water could be obtained from the chalk were indicated; and the reservoirs proposed to be constructed were shown on the plan. They proposed to bring into every house, from the main, a sufficient quantity of water for drinking and culinary purposes. It would be evident to the Board that the water, as at present supplied, although perfectly good for all cleansing purposes, was not of that good quality which was essential for drinking purposes. The constant supply, direct from the main, was wanted for domestic and fire purposes, and in every street in the Metropolis hydrants would be erected at given distances, from which, at the moment a fire was discovered, a body of water could be brought to bear upon it of sufficient force, so as almost immediately to extinguish it. There would be an annual saving of the companies profits, and the alteration of existing house-fittings would be reduced to a minimum, one simple and inexpensive fitting for each house being all that would be required. These were the advantages of the new system. In reference to the financial part of the question, he might state that to extend existing works, as he had before stated, would cost £337,000 a year, and the scheme now brought before the Board would cost only £225,000 a year, so that there would be a saving of £112,000. He thought they might fairly place themselves in the hands of Sir Joseph Bazalgette, who had since the creation of the Board been their adviser, and that the Board would have confidence in his opinion, more especially when they found, in conjunction with him, the names of Mr. Bramwell and Mr. Easton. The estimate was as follows:—Reservoirs, pumping-stations, and sites for same, £512,000; mains from pumping-stations to reservoirs, £533,000; arterial and distributing mains, including crossing the river and paving, £3,195,000; hydrants, fixed upon the supply mains when being laid, £600,000; house-fittings, £600,000—making a total of £5,440,000—and, in addition to that, there would be £32,500 for pumping. The annual cost of the new works would be £225,000 a year; but against that there was a very material saving. The committee considered that the hydrants being there, the water being always on, and there being no difficulty in obtaining a large and plentiful supply of water, it could be used with great advantage for the purpose of watering the roads. At the present time, the various vestries and district boards paid £33,000 a year for the water for watering their roads. The new scheme proposed to give that to them without any payment whatever; and it was perfectly right they should do so, because the cost would be thrown over the whole of the Metropolis. Then it cost the vestries and district boards £61,000 a year to distribute the water; the total cost being, in round figures, something like £95,000 a year, which the present vestries and district boards were paying for the purpose of watering their roads. The engineer had calculated that out of this there would be a saving of £70,000. Deducting that from the £225,000, the result was £155,000 a year as the cost of the new scheme. There would also be a further saving of £50,000 a year, which had formerly been spent on the plant of the Fire Brigade and the necessary stations, and this would reduce the cost of the new scheme to about £100,000. Supposing it even to be £150,000 a year, this could be met by a threehalfpenny rate. If the present scheme did not meet the approval of the members, what did they propose to do? It was no use saying they did not approve of it, without bringing forward something else. The Board had pledged themselves to Parliament to purchase the existing companies. If they went to Parliament they must be prepared to do something more than was done now; they must be prepared to supply existing defects. It was known that the companies were about to apply to Parliament, and to expend a vast amount of money for extending their works. It became a question then as to whether the Board should sit silently, as it were, and not propose something for themselves. They were the sole municipal authority having jurisdiction over the Metropolis, and it was very imperative indeed to ask Parliament to place in their hands the existing water supply, and to authorize them to expend such sums of money—large though they might be, but which they believed to be necessary—in the interests of the public generally. In conclusion, he begged to move that the report be approved and adopted, and that a Bill for the compulsory purchase of the existing water companies be introduced as a public measure.

Mr. WALKER seconded the resolution.

Mr. LESLIE said that Mr. Roche had entirely omitted one important fact from his speech. There were at present 52 per cent. of the houses in the Metropolis already supplied with that pure, potable water which it was thought so desirable to bring into the Metropolis, and 51 per cent. of the population were drinking that water; therefore they were not at all likely, when they understood the question, to come forward and pay for getting that which they already possessed. The total daily supply which was accessible to the Metropolis was 118 million gallons, of which the New River Company supplied 26 millions; the East London, 24 millions; the Kent, 7,190,000. Let the Board go to Parliament, as suggested by Mr. Roche; it would be a capital thing for the parliamentary agents. If half the population were already supplied with good water, he thought they

should not be interfered with. He observed that, on the 24th of last month, at the Auction Mart, 1-40th part of a share in the New River Company was sold for £2340, or at the rate of £97,200 per share. The whole of this company's shares were freehold property. The cost of purchasing the water companies, including the New River Company's property, he estimated at 40 millions sterling. He hoped the Board would pause before they entered upon such a speculation, and moved as an amendment—"That the report be printed and circulated to the vestries of the Metropolis, asking them to give their opinion upon a question of such immense importance."

The amendment was not seconded.

Mr. CUFFLIN, although desirous of seeing a pure and unlimited supply of water, and a supply of water at high pressure, thought it was undesirable to proceed with the two Bills. He thought that nearly all Mr. Roche's arguments were adduced in favour of the second proposal. One of the strongest reasons urged by the Fire Brigade Committee against the efficiency of the Fire Brigade was that there was not a constant supply of water at sufficiently high pressure for the purpose of extinguishing fires. It appeared to him that the second Bill—which embraced the scheme—was formed entirely to meet the complaint of the Fire Brigade Committee. The scheme as proposed was a very ingenious one, and he certainly did not at all disapprove of it; but he did not think that this was the time to go to Parliament with a separate Bill to obtain it. He was not so sure they were all agreed as to the necessity of purchasing the water companies who supplied London. He was well aware that in the Houses of Parliament they would have the water interest, the gas interest, the railway interest, and every other monopoly interest adverse to them; but against this there was the consideration that the House of Commons had appointed several committees, and that they had all reported in favour of the Board. Royal Commissions had been issued, meetings, scientific and unscientific, had been held, and one and all had said that the supply of water to the Metropolis should not be in the hands of seven or eight companies—that it was not at all conducive either to a good, a proper, a pure, or an economical supply. Placing these considerations against the interests he had alluded to, he was not sure but that the House of Commons would give the Board the power for which they asked in the Bill, especially when it was well known that several towns in the kingdom had really been granted this right, and had exercised it very materially to the interests of the people living in those towns. They had been furnished with better water, in larger quantities, and much more economically; in addition to which they had been supplied at the same, or a less price than they had been in the habit of paying. Supposing the House of Commons threw out the first Bill—which was rather almost expected by many persons—he thought that the ratepayers of London would offer a very strong objection to the second scheme. They would say: "We are harassed enough by the despotism of these seven or eight companies, and we do not want another body coming to supply us, and tax us extra for the additional supply." Further than that, he was of opinion that if they asked for the second Bill without obtaining the first, they might naturally expect they should never be able to purchase the companies. Upon what expectation could they hope to go hereafter to Parliament with a Bill for the purpose of accomplishing it? The House of Commons would only say, "What more do you want? You have a supply of what you call not very perfect water; but you also have a supply of pure water now; and you also have a supply of it in almost unlimited quantities, and you certainly have it at a high pressure. If we could not give you power to buy up the companies before, we certainly cannot think of now giving you power to do so." He did not believe that if the supply of water was in the hands of the Board they could adopt the second scheme as it now stood. He did not think that they would be at all inclined to lay out a scheme for furnishing pure water to the houses of the Metropolis in a very limited driblet, and at the same time propose to give an almost unlimited supply of pure water for the purpose of putting out fires and watering the streets. He recommended the Board to apply for the first Bill pure and simple—in fact, to do what other towns had done—and then, having obtained it, they would have other means of procuring pure water to an unlimited extent. Having the second Bill, the scheme would be criticized; the scientific world would turn it inside out, and have an opportunity of finding out whether there were any defects in it, and of pointing out the means which would then be available for remedying it. He was quite sure that if the first Bill was obtained—and the second was of no use without the first—they should then do everything which Mr. Roche had suggested was right and proper to be done in the interests of the Metropolis, and do all that the companies had threatened or had ever promised to do. He believed that if the supply of water went into the hands of the Municipality they could supply it more economically than the water companies. It was not a question that in any way deterred him. He was anxious to do everything in his power to promote the objects stated by Mr. Roche, but he did not approve of the way in which it was proposed to carry them out.

Mr. RUNTZ moved, as an amendment, that, instead of the report of the committee being approved of, only so much of it as had reference to the purchase of the water companies should be accepted, and that the Bill to be introduced in the next session of Parliament should be a public Bill, and on the principle recommended by the committee. He thought that there was no more important question that could occupy the attention of the Board than that of the supply of the necessaries of life to the public. It seemed to him that it was entirely wrong that the supply of a necessary of life should be a monopoly in the hands of those whose first consideration was that of profit. In his judgment it should be in the hands of those whose first consideration would be plenty and purity. For years he had done what he could in order to get the water supply of the Metropolis into the hands of the Board. It might not be out of place to review the past and present position of the Board in reference to this matter. In 1869 there was a report, known as the Report of the Royal Commissioners on Water Supply, which recommended that the supply of water to London should be in the hands of a public authority. The Metropolitan Board then had a discussion on the question, lasting over three days, and it was determined to ask the Government if they would do anything to carry out the wishes of the commissioners. Sir John Thwaites called on the then Home Secretary, Mr. Bruce, who considered that it was so great a question that nothing should be done until some attempt was made to re-model the government of London. It was put aside for that purpose; but, after a year or two, the same Government seemed to have altered their minds, and, in 1871, a Bill was introduced by the Home Secretary for the purpose of handing over the water companies to a public authority. The Metropolitan Board of Works entirely approved of the Bill; but to their surprise that Bill, before the second reading, was suddenly withdrawn, and they came to the opinion that the water companies had such power in the House as to frighten the Government. Then Bill No. 2 was introduced; but it was so much in favour of the water companies, and so little in favour of the consumers, that the Board expressed their disapproval of it, and determined to oppose it, and they sent a special deputation to express such disapproval. However, the second Bill of the session of 1871 became law. It conferred some small power on the Board of Works with reference to constant supply; in fact, it gave power to order a constant supply, but, under all the circumstances, they did not think it right to exercise these powers, and had refrained from doing so. A Bill was brought in in 1875 for the purpose of handing over the supply of water to a body of commissioners. The Board opposed it, and it was thrown out. In 1875 there was also a new assessment of the Metropolis, and the water companies, taking advantage of it all over London, began to increase their charges for water, and the Board thought it desirable to take some steps in the matter. They referred the question to a committee, and just at the same time the Corporation of London also referred the same question to a committee. Those two committees met several times, and he thought that every member of both committees was of opinion that it was exceedingly desirable that the supply of water should be in the hands of a public authority, and that no delay should take place in making application to Parliament for the purpose. The Board approved of the suggestion of their committee, but the Common Council did not approve of their committee's report, and the joint action of the two bodies was therefore for the moment paralyzed. The Board then communicated with the Corporation of London, but received no answer; and after the lapse of twelve months another communication was made with the same result. That was the history of the affair since 1869. The Board had never lost sight of the question, and he thought he had a right to say that at the present moment they were more enthusiastic on the matter than ever they had been. It was desirable they should go to Parliament to purchase the companies as speedily as possible. He hoped that there would be an unanimous vote to the effect that it was desirable to go to Parliament to get into their hands the supply of water.

Mr. MUNRO seconded the amendment. He said that the question had been before the Board for so long a period, that he hoped the members would now take steps to purchase the water companies. With regard to the new scheme, he felt the Board had not had sufficient time to discuss the question, and that the ratepayers would be taken by surprise. There could be no question that the Board would have quite sufficient to do for one year in the purchase of the water companies, and he was anxious to see what the supply from the chalk could do to meet the requirements of the new scheme before they pledged themselves to the expenditure that would devolve upon them.

Mr. RICHARDSON supported the adoption of the report. He asked the Board to remember that a very influential deputation waited upon Mr. Cross about this question, and it had been the subject of very much discussion in the public Press. That deputation consisted of the Council of the National Chamber of Trade, and also included members of the vestries and district boards of the Metropolis. They went to complain, not only that the water supply was in the hands of the water companies, but also of the quality of the water that was being supplied, the imperfect manner in which it was supplied, and to urge the necessity of the whole supply for the Metropolis being placed in the hands of a public body. Direct reference was made on that occasion to the Metropolitan Board of Works. He rather thought that some of the representatives of the Board attended, and urged upon Mr. Cross to take some action in the matter, and yet Mr. Monro was afraid that his constituents would be offended at him for giving an intelligent vote on a subject to which they, as members of the vestry, had given their sanction. Mr. Cross said it was a very large and important question to deal with, and yet he could not see his way to take action in the matter. The Metropolitan Board, on the 12th of February, or a few days afterwards, passed a resolution to carry out the purpose for which the deputation appeared before Mr. Cross, and the whole of the Press of the Metropolis most strongly approved of the action taken by the Board at the time. He thought that, unless the two Bills were placed before Parliament as a complete scheme, the Board would fail in their object. Mr. Roche had not explained that in the capital sum to be expended, and which was put down at 5½ millions, was included the purchase of the hydrants. It must be borne in mind that the companies, at the present moment, were under statutory liability to put these hydrants all over the Metropolis, and that would cost a million; and inasmuch as that 5½ millions provided for this expenditure, the interest of the million should be taken credit for, and the rate would then be reduced to a penny all over the Metropolis for getting as potable a drink as possible, and for getting a constant supply at high pressure, which would be sufficient for the purpose of extinguishing fires and for other purposes. If the Board did not accept the report of the committee in its entirety, the whole matter would be stranded; and if it were stranded now it would be lost for ever, as the water companies were proposing to expend large sums upon the extension of their storeage and distribution works.

Mr. FOWLER said he could not help thinking that the question under discussion was the principle as to whether in future London should be supplied by a double scheme, or whether they should be content with a single scheme. When they considered what London was, with its 500,000 houses and its hundreds of miles of streets, he did not think the public would be prepared to accept a Bill that would tear up the whole of the streets and interfere with every one of the houses, and incur an enormous expense, without a single public discussion, until the one in which they were now engaged, and be hurried, as it were, and threatened into doing it. He thought it ought to be shown, on most incontrovertible evidence (before an independent supply was talked of) that the water of the Metropolis was not a good and wholesome water. The report of the Royal Commission of 1866, as well as the reports of Dr. Letheby, Mr. Dalton, and the Medical Officers throughout the whole of the Metropolis, showed that the water had been gradually increasing in purity; and if that was so, one of the arguments used by Mr. Roche was done away with. Dr. Odling, Professor Wanklyn, Dr. Miller, and Mr. Hawksley, all said that the water, as delivered to the Metropolis, was wholesome and sufficient, and that the inhabitants ought to be satisfied with it. As a proof that the water was good, he would call attention to the fact that the death-rate of the Metropolis had been gradually decreasing. When the question of the drainage of the Metropolis was brought up before the Board, it was not fought out in one single discussion, but was very carefully considered; and yet the members were now asked to hold up their hands for this double supply, and raise the large sum of 5½ millions, without having the slightest opportunity of laying the matter before their constituents. He, for one, could not vote for the scheme in its entirety. He thought the second scheme was introduced for the purpose of the Fire Brigade, and for giving an answer to the adverse report of the Select Committee. The real reason was because the Board were afraid that they would be unable, unless at a great expense, to place hydrants on the high-pressure services, in order to put out fires. He was in hopes that the Board would have carried out the principle originally laid down—namely, to go and buy up the water companies. They would then have an acquirement, and they would be able afterwards to go into the question as to what was best to be done in order to comply with the requirements of the public. If the second supply which was proposed was sufficient for everything, why should the Board buy up the water companies? This would be a waste of public money. He was not advocating a question of confiscation; he would leave that to some one else. He protested most strongly, in the name of his constituents, against them being fixed with this double supply without his having the least opportunity of consulting them upon the subject. He thought that the

scheme would meet with the strongest opposition, and that in the end the great object for which it was intended would not be attained.

Mr. SELWAY said that the amendment moved by the member for Hackney was designed to confine the attention of the Board to purchasing the existing works of the companies. It was a speech, however, that was entirely outside the question, because several months ago the Board passed a resolution affirming the principle of the first Bill. Two members had spoken of the impropriety of urging a vote on the second proposition, because of want of time. These gentlemen must have forgotten that this subject had been before the Board for many months, and that the report of the engineers was printed, by order of the Board, and circulated throughout all the vestries and various other public bodies; and there had, therefore, been abundant opportunity for discussing the scheme out of doors, so that he did not think there was any ground for saying that members were taken by surprise in being asked to express their opinion in favour of the report, which bore the names of three such celebrated engineers as Sir Joseph Bazalgette, Mr. Bramwell, and Mr. Easton. He thought the question could not be discussed piecemeal, but that it must be taken as a great whole. Some gentlemen had spoken as if there were no defects to remedy; but they must all be agreed that the existing water supply of the Metropolis was defective in various ways. There were about 120 million gallons of water sent into the Metropolis daily; and of that quantity about one-sixth might be regarded as pure spring water, supplied from the chalk. The other five-sixths was an impure water in varying degrees. He did not say that all the water supplied to the Metropolis by the companies was of the same bad quality; but he contended it was not such water as should be supplied to the Metropolis. When he was younger, he took pleasure in studying minute nature, and in the house in which he lived he had not much difficulty in pursuing his studies. Nor was there difficulty at the present moment. Strangely enough, he had on the previous day received from a friend a very singular statement, which would show to the Board that organisms existed among the water in the Metropolis somewhat larger than of a microscopic character. Three weeks ago the water of his friend's house was stopped, and he sent for a plumber, who cut the pipe over the cistern, and found an eel about 22 inches in length; and it must have been 3 inches in girth, as it filled a 1-inch pipe. A previous speaker had mentioned the names of some medical men who said that the water supplied to the Metropolis was not impure; but in the Royal Commissioners Report of 1874 there were these words: "The commissioners recommend that the Thames should be abandoned as a source of water for domestic use." The same commissioners recommended that the Lea should also be abandoned as a source of potable water; so that the evidence of this important commission, presided over by the Duke of Richmond and Gordon, went to show that the Thames and the Lea were inefficient sources of supply. He maintained that the water was impure, and that the present system of supply was insufficient. The great evil from which the Metropolis suffered at the present time, and which he hoped the Board might be able to remedy, was the gross inequality of rating which existed all over the Metropolis; and he would remind the members that the water companies within the last few weeks had been issuing notices to their consumers increasing their rates. Royal Commissions had said over and over again that the quantity of water supplied to London must be increased. But where was it to come from? Were they to take still more from the River Thames than they did at present? For his own part, he had a strong objection to drinking diluted sewage. The water no doubt might be to a great extent oxygenized and purified; but when it was remembered that a large number of towns and villages were on the River Thames, and that the adjoining land was in a high state of cultivation, no amount of filtration could sufficiently improve the water. What the committee recommended was, that a pure spring water should be supplied, which should be in every man's house, at all times ready for potable purposes, and without additional charge. There would also be a fire service, which they did not have at the present time. He supposed that nearly all the members were agreed that the Fire Brigade of the Metropolis required extension and improvement. If this were not admitted, of course there was no necessity to bring an additional supply of water into the Metropolis for fire purposes; but, seeing the number of accidents and lives lost from fire at the present time, there should be a better fire service, and water for this purpose should be supplied in abundance. It was stated that water for all purposes could be obtained from the chalk; but he did not think that this, though probable, was possible. There was, no doubt, abundance of water in the chalk, but a large portion of the rainfall was absorbed, and existed in fissures beneath the surface. The advantages which would result from the adoption of the whole scheme were such that he trusted the Board would not hesitate to adopt what the committee recommended. The advantages would be—greater efficiency and greater economy of management; a better supply to the houses in the poorer districts; the streets would be cleaner and better watered; there would be better protection for property and life; and, above all, the water would be pure.

Mr. FREEMAN said that from the remarks which fell from one of the members it was clear that they would not be unanimous, because all his arguments went against the Board endeavouring to purchase the companies. He tried to make out that sufficiently clear and pure water was being supplied, and if this fact were established in abundance, then it would not be necessary for the Board to purchase the companies. Every one must have gone with the argument used by Mr. Runtz. Was it not a monstrosity that three and a half millions of people were dependent upon those who supplied water from commercial motives? They ought undoubtedly to be in the hands of a corporation, who would consider the health, the cleanliness, and the well-being of the people. He held, therefore, that it was the duty of the Board to purchase the companies; not because they had an itching palm, or wished to confiscate property, as the companies must be dealt with in a spirit of justice and equity, and must receive for their property whatever it was worth. It appeared to him that the only real point of difference between them was whether they should go in for one measure or two, for they were all of opinion that the companies ought to be bought up. He, for one, rejoiced when he saw that the scheme presented by the engineers supplied the very people who most needed to be supplied. The report, which seemed sound and feasible, had removed the great difficulties that were staring the Board in the face. He could not help thinking, however, that Mr. Runtz's recommendation was most suicidal, and would weaken the position of the Board in Parliament. If they could not now make up their minds to go in for the whole affair, they had better put it off till next session, when they might be able to go forward with a sound and sensible scheme. He was quite aware that the companies intended to amalgamate, but he would much rather not go with an inadequate scheme before a parliamentary committee.

Mr. ROGERS believed that every man who voted for and signed the report was, like himself, under the impression that the scheme was needed, but there was some difference of opinion as to the means for carrying it out. He did not say that the water of the Thames was entirely pure, but Dr. Frankland, who was one of the most experienced analysts of the present day, who was appointed by Government, and who was known to disapprove of the present system, in his report for October, said, as the result of his analyses, that the water supplied in some parts of the suburbs was of good quality, while the Lea water furnished by the New River Company and the East London Company was, in chemical purity, equal to deep well water. Insurance companies a few years ago did not pay any dividend, but now some were paying 50 or 60 per cent., and they ought to be called upon to contribute a larger share of the expenses of the Fire Brigade. If the Board went to the House of Commons now, and asked for powers to buy up the water companies, the proposal would be a very popular one, and the powers would be granted, and afterwards they could present the second scheme. He submitted that, if they went with a scheme like the one proposed, which the ratepayers at large would be sure to oppose, they would not obtain it. If the power of the water companies in the House of Commons was so great, and the Board could not get the one Bill, they would not get the two. He hoped the Board would pause before they committed themselves to so gigantic a scheme, and would agree to the amendment.

Mr. WALKER said that as he, in February last, introduced the resolution for the formation of a sub-committee, he trusted that the good sense and intelligence of the Board would be unanimous in favour of the resolution now before them, and that those who came there biassed in reference to this question would cast that bias aside, so that every householder in the Metropolis might have a supply of water on the most economical terms. He held that the two Bills ought to go together, because the one was calculated to assist the other. When the Fire Brigade was properly worked, and a constant high pressure obtained, there would be a saving of £80,000 a year upon the Fire Brigade alone. The experience of large towns containing 500,000 or 600,000 inhabitants ought to show them that the results would be equally beneficial to London. The present expense of the Manchester Fire Brigade was only £2400 a year, and of the Liverpool Fire Brigade £4700 a year. There were also the questions of consolidation, collection of the rates, watering the roads—not sprinkling them, but watering them in a proper and efficient manner, so that the health of the Metropolis might be improved. A further consideration was that of cleansing the sewers daily. Nearly all the large towns of the kingdom were taking the water supply into their own hands. According to the report of the engineers of the new scheme, such a pressure would be obtained that a jet could be thrown to a height of 100 feet, in order to put out fires. One speaker had said, "Why not pump the water from the Thames?" But in order to do this all the mains in the Metropolis would have to be relaid. The more he studied the subject, the more he saw that both the Board and the public would be in favour of the scheme now presented to them. With six stations round the Metropolis, if the supply from one partially failed, the others might have an excess. Dr. Frankland's report for October had been referred to; but in his report for September, which gave the result of his analyses of the water supplied to some of the suburbs in that month, he stated that the Thames water furnished by the Chelsea, the West Middlesex, the Grand Junction, and the Lambeth Companies, showed greater pollution by organic matter than in July or August, and that the water supplied by the New River Company and the East London Company was good in quality, and had been properly filtered; but some of it was derived from the chalk. That was a strong bill of indictment against the companies, and if Parliament would recognize it he thought that the Metropolitan Board of Works were the proper persons to supply water to the Metropolis. He did not think the question of expense need be gone into—whether it would cost £20,000,000 or £21,000,000. They must recollect that they would be in the hands of a committee of the House of Commons, and if they, as representives of two millions of people, had not sufficient confidence in themselves, they should not go there at all. But if they had, then let them not listen to the men who suggested procrastination. They had waited long enough—in fact, they were half a century behind some of the country towns in this respect, and it was high time that they endeavoured to put themselves in a proper position.

Mr. THOMPSON said that every house of the poorest description in the parish of St. Luke's was adequately supplied with good pure, clear river water. The question, he held, turned entirely upon the report of the Select Committee of the House of Commons. It was a question of Fire Brigade purposes, and nothing more. From his connection with the Fire Brigade Committee he had not learned that there had been an inadequacy of water to extinguish fires. Fires would not diminish at the expense of such an enormous scheme as the one proposed. It was given in evidence before the House of Commons committee, that there was £540,000,000 of property insured, and of this amount only £138,000,000 related to building. The ratepayers paid in round numbers, in 1876, some £50,000, and they paid also their fire insurance upon the buildings for which they were rated; whereas the fire insurance offices, having £402,000,000 of goods insured, only contributed £18,000 during the year to the fund. It seemed to him, when these facts were taken into consideration, that an expenditure of £225,000 for the purpose of assisting in the extinction of fires was not at all what it ought to be. If the £540,000,000 of insurance were taken at a premium of 40s. per £1000, the income of the fire insurance offices would be over £1,000,000. He asked whether, under any system of fire protection for the Metropolis, it would become possible that one-half of the present number of fires would be prevented. If the matter were looked at from a Fire Brigade point of view, they had better call upon the ratepayers for a little additional sum per year, so as to increase the fire establishments, and thus prevent this great loss to the Metropolis. It had been argued that, by the proposed scheme, water would be brought to every house in London; but he wanted to know why, by the scheme, the pure water of the New River and of the East London Companies could not be extended to the Metropolis for potable purposes, while the other and more impure water was reserved for fires. It would be impossible for him at present to vote for the motion, because neither the members of the Board nor their constituents outside had had time to consider so large and important a question. They had better stay their hands for five years, rather than burden the Metropolis with a charge that would hang upon it, without being quite clear that the result would be commensurate with the cost.

Mr. FELL briefly supported the motion.

Mr. EDWARDS took exception to the statement that there was sufficient water in the Metropolis in case of fires, for Captain Shaw, in a recent report, had said that there was not sufficient. The Metropolitan Board, as the municipal authority, ought, he thought, to have the water under their control.

Mr. ROCHE, in reply, said that the arguments in opposition to the scheme propounded by the sub-committee, and recommended by the committee of the whole Board, were of such a character as not likely to have much weight with the members. There seemed to be three classes of opposition. There was, first of all, that universal objection—the policy of inaction, recommended by Mr. Thompson. The other was an emasculated policy, recommended by Mr. Runtz, who wished to adopt the one measure but not the other. The motion was that the report of the committee be approved and adopted. This pledged the Board to carry both the schemes; but Mr. Runtz wished the Board merely to go to Parliament to purchase, but not to ask to do anything else. Then there was the opposition policy propounded by Mr. Rogers. Mr. Cuffin had very properly said, "Why do you not do what they did in Manchester?" But

the Corporation of Manchester did not go to Parliament with any emasculated policy of simply buying up, but for a scheme which they believed would be sufficient for their present and prospective wants. Upon that policy the Metropolitan Board were now asked to go to Parliament. The member for Lambeth had attributed the reduction of the death-rate to the increased purity of the water; but it had always been in his (Mr. Roche's) mind that one of the causes of the lowering of the death-rate in the Metropolis was the great improvement in its sanitary conditions that had been brought into operation by the Board. He was not aware that the water was materially better than it was ten years ago. It had also been said that time had not been given to the members to consult their constituents; but he thought it was the duty of all the members of the Board to look at the questions brought before them in a large and broad sense, and to confront their constituents boldly, and fearlessly state the reasons why they had acted, but not to go to them for instructions. He trusted the Board would never become a meeting of delegates. Every member of the vestries had had a copy of the scheme, and there had not been any opposition from a single one of them. There was another scheme advanced—that Thames water could be used as well as pure water for the extinction of fires. Undoubtedly; but it would cost twice as much to obtain it—at least, it would cost £112,000 more than the present scheme. The committee had recommended a clear and definite policy, following on what was done at Manchester and other places, not only to buy up the existing companies, but to cure certain defects; and no policy whatever had been brought forward by any single member of the Board which for one moment could be placed in opposition to the one proposed. He trusted that the Board would carry, by a large majority, the report of the committee, and that they would do all they could for their constituents in the Metropolis.

A vote was then taken on the amendment, for which there appeared 13; against it, 17.

For the resolution 17 hands were then held up, to 12 against it. The amendment was declared to be lost. A division was called for, and the result was—for the resolution, 17; against it, 13.

Mr. Roche then moved that a Bill be introduced as a private measure for the purpose of carrying into effect the recommendations of the committee for a new supply of water, and that the course taken by the committee be approved.

A show of hands was taken, when 17 (including the chairman) voted for the resolution, and 13 against it. Another division was called for, when the same decision was come to, as also for the publishing of the notices in the *Gazette* with regard to the undertaking.

Court of Common Council.

At the Meeting of the Court on Thursday, the 15th inst.,

Mr. Boon asked the chairman of the Gas and Water Committee (Mr. Shuter) whether his attention had been called to the decision come to on the previous day by the Metropolitan Board of Works on the subject of the water supply of the Metropolis, and whether the committee were going to take any steps respecting it, either in conjunction with the Metropolitan Board of Works or independently.

Mr. Shuter replied that the matter had been under the consideration of the committee, but they had not yet decided on any action in reference to it.

Deputy Fry thought the question was too serious to be trifled with, and that the reply of the chairman was unsatisfactory. He asked whether the Court might expect to have a report on the subject from the committee.

Mr. Shuter said the matter was now before the committee, and would receive every attention. They would bring up a report as speedily as possible. The committee brought up a report some time since, asking for power to confer with the Metropolitan Board of Works, and that report was sent back.

Mr. Roake asked whether the Metropolitan Board had invited the committee to a conference in respect to the step they had just taken.

Mr. Shuter said no communication had been made by the Board. He would move—"That the Gas and Water Committee have power to confer with Her Majesty's Government and the Metropolitan Board of Works upon the subject of the supply of water to the Metropolis."

Mr. Edmeston seconded the motion, observing that the Court were opposed to pledging the City estates to purchase the water companies.

Mr. Bengough thought the Remembrancer should be instructed to give notice for a Bill

Mr. Bedford objected to such a course, remarking that, if the Metropolitan Board should go on with their Bill, the Corporation might endeavour to get clauses introduced to protect their rights.

After some further conversation,

Mr. J. E. Saunders said the Metropolitan Board were only pursuing a course indicated some months ago. In the wisdom of the majority of that Board they decided to give notices to buy the existing water companies, and at the same time to introduce a second Bill to improve the supply, and draw it from chalk sources. The total outlay, at the smallest estimate, would be £21,000,000—a very small sum, looked at from certain points. This was decided on, at a special meeting of the Metropolitan Board, on the previous day. He regretted it was a special meeting on a very short notice, as it was not fair to all the districts represented there. The Board had taken a bold step, and it might be wise or unwise. Their Bill was not likely to pass in the ensuing session of Parliament, and, therefore, the utmost that could be done by this Court, for the moment, was to give their committee power to confer with the various interests concerned. Two of the City members (Mr. H. L. Taylor and Alderman Truscott) were absent from the meeting of the Metropolitan Board on Wednesday. He (Mr. Saunders) was there during a part of the discussion, because he felt it his duty to hear it. He equally considered that, in the present juncture, on so large a matter, it was not wise for the City representatives to pronounce any distinct opinion *pro* or *con*, but to watch the situation, and while wishing to do what was right, to carefully weigh steps which might involve the metropolitan ratepayers in an undertaking that might be to them a serious financial difficulty. He hoped the Court would empower the Gas and Water Committee to confer with the Metropolitan Board of Works, and report what was wise and right to do.

The motion was agreed to.

St. Martin's Vestry.—At the meeting of the Vestry of St. Martin's-in-the-Fields on Thursday, a motion was submitted by Mr. Laing to the effect—"That a Vigilance Committee be appointed to watch over every additional burthen laid on the ratepayers by the Metropolitan Board, and more particularly the report of that body on the contemplated auxiliary water supply." He believed that the whole scheme would prove a failure, and that the expense of the experiment, which he described as a most hazardous one, would be almost ruinous, and such as the parishioners would not quietly endure. He pointed out that the scheme was quite unnecessary, as the examiners themselves had reported most favourably upon the water of the Metropolis. The motion having been seconded, Mr. Dalton, the representative of the Vestry at the Metropolitan Board, offered some explanations, and Mr. Watherston moved as an amendment—"That in the interest of the ratepayers, the proposal of the Metropolitan Board of Works be encouraged, but that each vestry should appoint a committee of three to meet in that hall to watch the progress of the measure in Parliament, and to advise with the Metropolitan Board on its provisions." The amendment was ultimately adopted.

The Registrar-General publishes the following returns of the average daily quantity of water supplied by the London Water Companies during the month of October, 1877. According to these, 122,683,192 gallons, or 557,406 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight), were supplied daily; or 228 gallons (103·6 decalitres) rather more than a *ton* by weight, to each house, and 32·1 gallons (14·6 decalitres) to each person, against 31·1 gallons during October, 1876.

Companies.	Number of Houses, &c., supplied in Oct., 1876.	Number of Houses, &c., supplied in Oct., 1877.	Aver. Daily Supply of Water in Gallons* during Oct., 1876.	Aver. Daily Supply of Water in Gallons* during Oct., 1877.
Total supply	530,183	538,021	117,228,345	122,683,192
From Thames	249,648	253,253	61,013,343	61,814,324
„ Lea and other Sources	280,535	284,768	56,215,002	60,868,868
Thames.				
Chelsea	28,737	28,859	7,702,406	8,425,200
West Middlesex	48,481	50,016	10,143,468	9,671,577
Southwark and Vauxhall	80,620	79,190	18,900,000	18,800,000
Grand Junction	36,616	37,683	10,887,175	11,057,547
Lambeth	55,194	57,505	13,380,300	13,860,000
Lea and other Sources.				
New River	124,922	126,144	25,271,000	26,919,000
East London	110,354	113,192	23,849,906	26,635,800
Kent	45,259	45,432	7,094,102	7,314,068

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for October, 1877, as compared with that for the corresponding month of 1876, shows an increase of 7338 houses, and of 5,454,847 gallons of water supplied daily.

Dr. Frankland reports as the result of his analyses of the waters supplied to the Metropolis and some of its suburbs during October, that, taking unity to represent the average amount of organic impurity in a given volume of the Kent Company's water during the last nine years, the proportional amount of such impurity in an equal volume of water supplied by each of the metropolitan water companies and by the Tottenham Local Board of Health, was:—Tottenham 0·5, Kent 0·6, New River 0·7, East London 1·2, Grand Junction 1·4, West Middlesex 1·6, Lambeth 1·8, Southwark 1·9, Chelsea 2·3, and Colne Valley 4·2. The river water supplied to London during the past month was of unusually good quality, that abstracted from the Thames being fully equal to what is usually obtained from the Lea, whilst the water from the Lea delivered by the New River and East London Companies was, on the average, equal, in chemical purity, to deep well water. Moreover, all the river water was efficiently filtered before delivery. The water drawn from deep wells by the Kent Company, and by the Tottenham Local Board of Health, was palatable, wholesome, and of its usual excellent quality for dietetic purposes. The Colne Valley Company's water, on the other hand, was exceptionally contaminated with organic matter of vegetable origin, and although such contamination need not excite alarm, its cause ought to be sought out and removed. This was the only metropolitan water soft enough for washing. Seen through a stratum 2 feet deep, the water supplied by the Kent, Colne Valley, and New River Companies, and by the Tottenham Local Board of Health, was clear and colourless, the remaining samples were clear and nearly colourless, except that drawn from the Southwark Company's mains, which was of a very pale yellow colour.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
Inner Circle.								
Thames—								
Chelsea	25·96	·112	·025	0	·158	·183	1·30	17·7
West Middlesex	27·80	·078	·017	0	·175	·192	1·30	20·1
Southwark and Vauxhall	27·32	·087	·027	0	·210	·237	1·32	19·7
Grand Junction	28·04	·067	·018	0	·219	·237	1·32	20·7
Lambeth	28·38	·091	·015	0	·256	·271	1·55	20·4
Other Sources—								
New River	26·46	·030	·011	0	·251	·262	1·60	20·3
East London	27·66	·055	·017	0	·161	·178	1·80	20·9
Kent	42·24	·030	·008	0	·573	·581	2·60	26·6
Outer Circle.								
Colne Valley	12·64	·220	·029	0	·337	·366	1·42	5·0
Tottenham Local Board	46·10	·023	·009	0	·441	·450	3·10	26·4
Corporation of Birmingham*	25·00	·137	·024	·002	·253	·278	1·9	16·2
Corporation of Glasgow†	3·00	·196	·004	·001	·005	·010	·6	·6

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of the Andersonian University, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

Major Bolton reports that the state of the water in the Thames and Lea was very good during the month of October. Of the companies drawing their supplies from the Thames, the West Middlesex, East London, and Lambeth have sufficient storeage capacity and impounding reservoirs to avoid taking in water when floods prevail. The Chelsea Company have completed the construction of the four new subsiding reservoirs at Molesey, and the Southwark and Vauxhall and Grand Junction Companies have acquired land for the construction of suitable storeage reservoirs and other works at Hampton. The water in the river Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was very good during the month. The highest flood state of the river at Hampton during the month was 9 inches above, and the lowest was at the summer level. The condition of the water in the river at Ditton was also very good during October.

Birmingham Water Supply.—Dr. Hill, Medical Officer of Health for Birmingham, reports that the water supplied to that town during October was clear, and exhibited a marked diminution in the quantity of organic carbon and nitrogen.

BIRMINGHAM CORPORATION GAS SUPPLY.

At the Adjourned Quarterly Meeting of the Birmingham Town Council, on the 13th inst.—the MAYOR (Alderman Kenrick) presiding—

The report of the Gas Committee which we published, in the "Circular to Gas Companies," last week was submitted.

Mr. MARRIS moved its adoption. In doing so, he referred to the attention which the committee had given to the question of bad debts made in connection with the gas accounts. They found that those bad debts compared very unfavourably with gas undertakings in other towns. For the year ended Dec. 31 last they lost £3804, or nearly ·38 of a penny for every 1000 cubic feet of gas sold, while The Gaslight and Coke Company of London lost only about ·22 of a penny, and the Corporation of Manchester, for the year ending June 30, 1876, lost only £840, in bad debts, or ·10 of a penny per 1000 feet of gas sold. With a view to remedying this state of things, the Gas Committee introduced some more stringent measures, the operation of which was to reduce the unreasonably long credit which had been given by the old companies, and to afford greater certainty in the collection of the small accounts. With regard to these alterations in the rules, there had been some misapprehension. It had been thought by some people that the system of requiring deposits originated with the Gas Committee; but such was not the case, for it had been in existence for years past under the former companies. During the last year of their existence the former companies received 904 deposits, amounting to £911. The number received by the Gas Committee during 1876 had been 1688. The minimum required by the former companies was 15s., and the minimum required by the present committee was 20s. It was in order to ease the pressure which might in some cases be involved in the payment of deposits that the committee instituted the system of guarantees. That alteration was made entirely in the interest of the consumers; it involved a large amount of trouble in the offices, and he was not prepared to say that it had been altogether successful. With regard to the remarks which had been made as to the hardship inflicted on small consumers, he wished to point out that the committee made no charge whatever for meters, as was done in other places. He found that in Nottingham last year £4500 was received for hire of meters, in Manchester £9000, and by The Gaslight and Coke Company of London £33,000, while not a penny had been charged in Birmingham. If the Gas Committee had charged for the meters it would have been a far greater tax on the small consumers than the deposit or guarantee; but it would far more than cover the bad debts which were likely to be made. The committee had endeavoured to carry out their regulations in such a manner as to cause the least possible annoyance or irritation to the consumers. The committee were by no means clear that the new regulations would reduce the bad debts, or prevent their increase in the future with the increased consumption; but they felt it was their duty to carry on the gas undertaking in such a way as would most conduce to the comfort and convenience of the public generally. He might mention they had received in the last three months 14,000 accounts against 8000 in the corresponding period in 1876. It had just been reported that the amounts in arrear were £12,700, as compared with £26,900 at the same time last year. They had now a little over 40,000 consumers, and the committee, believing that the interests of the consumers and the ratepayers were identical, were doing their utmost to benefit both.

Mr. WHATELEY seconded the adoption of the report, and expressed his satisfaction at the modification of the arrangements which the committee had made.

Mr. BEARD called attention to the provision that an applicant for gas, who had not been a previous consumer, and whose premises were held on a weekly tenancy, should be asked to leave a deposit sufficient to cover a quarter's consumption; but when he had been supplied for two years in the same premises, and his account had been punctually paid, the deposit might be withdrawn. He considered that that provision practically meant that 34,000 or 35,000 of the inhabitants of Birmingham were to be considered dishonest until the contrary was proved. With regard to there being no charge for meters, he would remind the council that the scale of charges, under which the small consumers paid a higher price per 1000 cubic feet than the large ones, was so arranged by the former companies that the difference in the amount paid would cover the cost of the meters and the increased cost of collecting small amounts. He still considered that the requirement of a deposit or of a guarantee was a hardship, and he suggested that a better way to meet the difficulty, against which the committee were contending, would be to collect the small accounts when the meters were examined, fortnightly or monthly. With regard to the price of gas, he complained that the committee were now charging 12 per cent. more than was charged by the former companies at the time when materials were at the same price as now. He moved an amendment to the resolution, to the effect that, in the case of weekly tenants who had not been previous customers, the gas accounts should be collected weekly or monthly, but that after a person had paid his bills punctually for two years without giving trouble to the collectors, he should be supplied on the usual credit terms.

Alderman BRINSLEY seconded the amendment.

Alderman MANTON said that the greater rate which was made for small supplies of gas was made not only to cover the greater cost of collection, but the greater expense of a number of services.

Alderman AVERY supported the original resolution, and said he thought the guarantee required by the committee was most reasonable. If they were to substitute for it a personal application for payment once a fortnight, they would soon have a general outcry at a really substantial grievance, which would be resented by every one. He could see no injustice in the regulations of the committee, and he certainly could find no evidence of any general discontent on the part of the public. Within the last few days there had been an election of 16 members of the council, and out of the 16 not a single objection had been made to one of them on the score of what had been done. That very day, in consequence of the changes among the aldermen, there had been three more elections; and although the Gas Committee's report had been published, three gentlemen had been returned with the most perfect unanimity.

Alderman HEATON suggested the desirability of the committee considering the question of whether they might not advantageously furnish fittings to small houses.

Mr. HADLEY said the question was already under the attention of the engineer, who had been requested to report upon it.

After some further discussion,

Mr. MARRIS replied. He said that, with respect to the deposit or guarantee, the committee wished to do what was strictly just, and at the same time what was kindly to all the inhabitants of the town; but he altogether repudiated the idea that an unknown person had a right to come and demand a supply of gas on credit without security and without inquiry as to his means of paying. With regard to the proposal to collect the small accounts weekly, he could hardly think it was serious. They had hundreds and hundreds of cases in which the entire quarter's consumption did not exceed 1s. 6d. In the quarter ending the 31st of July last they had 22,757 accounts under 10s., and perhaps the council would kindly imagine having to collect those accounts in fortnightly instalments. Upon the point raised as to the price of gas, he called attention to the fact that the Gas Committee were charging less than most other corporations and large companies. It was true that the materials for making gas were cheap, but the people who complained about the price seemed persistently to ignore the fact that in the present state of the iron trade the sale of coke at a remunerative price was a matter of the greatest difficulty.

On Mr. Beard's amendment being put it was lost, receiving only the support of its mover and seconder.

The report of the committee was approved.

ON THE ANALYSIS AND VALUATION OF SPENT OXIDES OF IRON FROM GAS-WORKS.

By Mr. GEORGE E. DAVIS.

[From the *Chemical News*.]

In the *Chemical News*, vol. xxix., p. 30, I pointed out that there were sometimes present in spent oxides substances generally disregarded, but which played a very important part in the vitriol manufacture. Lime, or carbonate of lime, when present, abstracts or retains an equivalent of sulphur in burning the spent oxide, so that the amount now usually given, on the assay, note as available sulphur is not always available, and the consumer is called upon to pay for that which it is impossible for him to burn out. At and before the time the above paper was written it was usual, in many cases, to estimate the sulphur by oxidation of all sulphur present, and collecting the sulphuric acid by precipitation with a soluble barium salt, and then to estimate the sulphur present as sulphates by precipitation without oxidation, the difference between the two giving what was reported as "available sulphur." Then came the "bisulphide method," which consisted in dissolving out the sulphur with bisulphide of carbon, distilling off the bisulphide, and fusing the residual sulphurs. This method would give fairly accurate results were it not that tarry matters dissolve out also, which are difficult to eliminate by any after operation, without danger of losing sulphur.

This method was in use in my laboratory for some time, but experience showed that the results of the experiments did not show the real amount of available sulphur, there being at least two errors—first, the tarry matters dissolving out in the bisulphide of carbon used; and, secondly, if any carbonate of lime was present, its presence made no difference in the results of the analysis. It would certainly be possible to make a mixture of lime, or carbonate of lime, and spent oxide in such proportions that none, or but very little, sulphurous acid would be evolved on combustion; yet such a mixture would give abundance of sulphur—stated to be available—when examined by the bisulphide method. It is well known that, in most gas-works, lime is used in the purifiers, even where oxide of iron is used, and the lime and oxide being often placed in close proximity to each other for want of room, it is not very wonderful that the spent oxides should often contain carbonate of lime. In some cases, lime is purposely added to the purifying material, and it is certainly surprising that manufacturers agree to pay for what sulphur it is impossible to burn off, and also for tarry matters which they are aware will not make oil of vitriol.

Sometimes the sulphur obtained from the assay of the spent oxide by the bisulphide method is remarkably pure, at other times it is very impure, and cannot be properly purified without loss of sulphur. As instances, the following figures are given, which show the amount per cent. of pure sulphur in six different samples of the above sulphurs weighed by another chemist, who, an my request, saved them for me from his work:—

No.	A.	B.
1	90·41	90·19
2	97·60	97·52
3	97·38	97·44
4	92·66	92·74
5	98·92	98·88
6	99·84	99·93

In A the sulphur was ground up with a mixture of carbonate of soda and nitrate of soda, and projected into fused nitrate of soda in a porcelain crucible, the sulphuric acid being precipitated in the ordinary way as barium sulphate. In B the sulphur was dissolved by boiling with pure sodium hydrate, and a current of chlorine passed into the solution until the oxidation was complete; the sulphuric acid so formed was treated as in A.

The bisulphide method proving so unsatisfactory, I began to look around me for an accurate method—for one which would give the real amount of available sulphur—or that amount which would be liberated by the thorough combustion of the oxide under the varying circumstances, lime or no lime, tarry matters and other oxidizing substances. With this end in view, it was thought necessary to thoroughly examine all the spent oxides which are to be met with in commerce, to know once for all how the various constituents were likely to behave towards the reagents to be used, and under the physical conditions to which they were to be subjected.

The spent oxides of commerce may be divided into three classes:—

1. Those formed when precipitated oxides of iron are used.
2. Those formed when natural hydrated oxides of iron are used, such as bog-ochre, &c.
3. Those produced from copperas or dry copperas.

As instances of the first class may be cited the following analyses:—

	I.	II.	III.
Ferric hydrate	18·42	17·74	19·36
Sawdust	2·42	1·98	4·72
Carbonate of lime	None.	None.	1·04
Ammonium sulphocyanide	2·52	1·99	2·74
Ammonium ferrocyanide	Traces.	Traces.	Traces.
Tarry matters	0·72	0·84	1·22
Sulphur	67·18	66·22	62·44
Matters insoluble in dilute HCl	3·66	5·47	3·76
Moisture (by difference)	5·08	5·76	4·72
Total	100·00	100·00	100·00

The spent oxides of the second class being produced from oxides of iron not in such a fine state of division as the first class, generally contain more ferric hydrate and less sulphur; the difference in oxide, however, does not alter the accidental constituents, such as sulphocyanide and tarry matters.

The following analyses will show the composition of oxides of the second class:—

	IV.	V.	VI.
Ferric hydrate	26·42	25·91	15·96
Sawdust	1·24	1·14	3·72
Carbonate of lime	None.	1·73	0·46
Ammonium sulphocyanide	1·93	1·87	0·94
Ammonium ferrocyanide	0·21	Trace.	Trace.
Tarry matters	1·14	0·96	0·92
Sulphur	50·42	48·76	57·44
Insoluble matter in dilute HCl	11·42	11·42	9·74
Prussian blue	Trace.	0·17	Trace.
Moisture (by difference)	7·22	8·04	10·82
Total	100·00	100·00	100·00

Examples of oxides of the third class may be seen in the following analyses:—

	VII.	VIII.	IX.
Ferric hydrate	5·04	7·23	6·84
Sawdust	1·89	3·24	1·04
Carbonate of lime	None.	None.	None.
Ammonium sulphocyanide	2·52	3·41	1·98
Ammonium ferrocyanide	0·64	0·27	0·33
Tarry matters	1·18	0·72	0·43
Sulphur	55·74	48·76	52·46
Insoluble matters in dilute HCl	7·82	10·65	12·68
Calcium sulphate	1·43	Trace.	0·72
Ammonium sulphate	12·78	16·72	15·54
Prussian blue	1·74	0·22	Trace.
Moisture (by difference)	9·22	8·78	7·98
Total	100·00	100·00	100·00

The foregoing analyses represent very fairly most of the spent oxides found in commerce. Occasionally very bad ones are found, containing very large quantities of carbonate of lime or sawdust, or happen to contain very little sulphur or large quantities of moisture. The following three analyses are of samples of bad oxides:—

	X.	XI.	XII.
Ferric hydrate	20·40	8·72	10·99
Sawdust	2·16	9·76	3·18
Carbonate of lime	10·36	5·87	None.
Ammonium sulphocyanide	4·72	0·76	1·18
Ammonium ferrocyanide	Traces.	0·34	0·44
Tarry matters	0·67	1·04	0·55
Sulphur	32·42	42·16	36·78
Insoluble matters	16·76	20·71	12·12
Calcium sulphate	3·23	1·77	None.
Ammonium	None.	0·74	1·14
Prussian blue	Traces.	0·64	0·21
Moisture (by difference)	9·28	7·49	33·41
Total	100·00	100·00	100·00

Having the results of many analyses like the foregoing twelve in view, and after many trials and experiments, the only correct method of estimating the *available* sulphur, which could be done in a short space of time, was to make a combustion of the sulphur, thus imitating the operations of the manufacturer.

The advantages of a combustion method are self-evident, tarry matters are burnt into carbonic acid, and any carbonate of lime present retains its equivalent of sulphur, which equivalent would not appear in the report of the analysis.

The process has been in use in my laboratory for over six months, during which time over two hundred samples of spent oxides have been examined by it. The results have been perfectly satisfactory, therefore the bisulphide method has been discarded as not always trustworthy, because it does not always give the true amount of *available* sulphur, which the combustion process does.

In experimenting upon the process, it was at first surmised that the tarry matters, sawdust and cyanogen compounds would interfere with any process which depended upon the volumetric reduction of standard solutions, and as the first samples operated upon contained no sulphate of ammonia, the unwashed sample was burnt, and the sulphur dioxide passed into diluted peroxide of hydrogen, the sulphuric acid so formed being weighed as sulphate of barium.

This was found too long and tedious a process, and the cost of peroxide of hydrogen was great; so, after numerous trials and experiments, the gravimetric process was abandoned for a volumetric one.

It would swell this paper to an unnecessary length to enter into the details of all the trials and failures performed and obtained upon this subject, therefore I will proceed to describe the combustion process at length, exactly as it is now carried out in my laboratory.

Generally the report of the analysis includes the quantities per cent. of moisture, sulphate of ammonia, and sulphur. With the two first it is unnecessary to describe their estimation, only so far as it relates to this process.

Five grammes of the oxide for analysis are weighed off and dried at 100° C. till it ceases to lose weight, which generally takes about two hours. After weighing, the dried sample is transferred to a beaker and digested with hot water, then washed on to a tared filter, and thoroughly washed with water.

The filter is then placed in the drying-oven until it ceases to lose weight at 100° C. When thoroughly dried it is weighed again, the weight noted, and the filtrate is used for the estimation of the ammonia, which is calculated as sulphate, though it will be seen by the analyses of the foregoing oxides that the ammonia is often combined with several other acids, and that often no sulphate of ammonia is present. The washed and dried residue is then finely ground up in a mortar, and 0·16 gramme is weighed off into a porcelain boat in a thin layer about 2 inches long, when it is ready to be placed in the combustion-tube, which has been heated to low redness for its reception.

The furnace used may be of any form—that used in my laboratory is Glaser's pattern, and the combustion-tube, of very infusible potash glass, lies in a packing of asbestos. The tube projects about 2 inches from each end of the furnace; one end is left open, and the other is fitted with a good cork, through which passes a glass tube. Connected with this tube, by a very short piece of india-rubber tubing free from sulphur, is a bottle fitted with a caoutchouc stopper holding two tubes, one penetrating just below the stopper, and the other reaching nearly to the bottom of the bottle. When the furnace has been heated sufficiently, 60 c.c. of decinormal iodine solution are placed in the bottle and well diluted with water. The short tube of the bottle is then connected with the Bunsen pump, and a steady current of air drawn through the tube. The boat containing the oxide is now pushed gradually and cautiously into the tube, so that the sulphur burns slowly from the front to the back of the boat. When the flame of the sulphur has all disappeared, the boat is pushed into the full red portion of the tube, and left in the current of air for about three minutes. At the end of this time the boat is withdrawn and the contents of the bottle titrated with decinormal sodium hyposulphite, when, if 0·16 gramme has been taken, each c.c. of iodine solution reduced will give the per centage of sulphur direct.

The above is the number of parts of sulphur in 100 of the residue, freed from moisture and all soluble constituents; a calculation is therefore necessary to know what the per centage would be upon the original sample in its unwashed and undried state.

In order to better describe the process, the following is given, made upon a sample of good oxide, exceptionally free from tarry matters, and free also from any bases likely to retain sulphur, and which, when examined by the bisulphide of carbon method, gave the following results:—

	Wet.	Dry.
Moisture	6·60	—
Sulphate of ammonia	18·30	19·60
Sulphur	42·70	45·70

5 grammes dried at 100° C. weighed 4·67 grammes, which is equivalent to 6·6 per cent. moisture.

The 4·67 grammes were then digested with water and washed on to a tared filter till free from ammonia. The filtrate when boiled with soda gave off ammonia sufficient to neutralize 13·9 c.c. of normal acid, or equal to 18·35 per cent. of sulphate of ammonia in the wet sample. The washed and dried residue weighed 3·722 grammes, and 0·16 gramme of this residue when burned in the combustion-tube gave off sulphur dioxide, which decolorized 57·1 c.c. of decinormal iodine.

From the foregoing experiments it will readily be seen that the 100 parts of the oxide experimented upon were made up as follows:—

Water	6·60	(α)
Soluble matters	18·96	(β)
Insoluble	74·44	(γ)
	100·00	

Sulphur in 100 parts of the "insoluble" .. $57·1 = \delta$.

The per centage of sulphur in the moist original sample (x) is found from the formula (1)—

$$(1.) \quad x = \frac{\gamma \times \delta}{100}$$

and the sulphur on the dry sample from (2)—

$$(2.) \quad \frac{x \times 100}{\beta + \gamma}$$

Formula (1) gives—

$$\frac{74·44 \times 57·10}{100} = 42·5$$

and formula (2)—

$$\frac{42·5 \times 100}{18·96 + 74·44} = 45·5$$

The two processes have given from the same sample of oxide the following results:—

	Bisulphide Method.	Combustion Method.
Moisture	6·60	6·60
Sulphate of ammonia (wet)	18·30	18·35
Sulphate of ammonia (dry)	19·60	19·64
Sulphur (wet)	42·70	42·50
Sulphur (dry)	45·70	45·50

The following results were obtained from spent oxides examined from time to time, and in every instance where the bisulphide method gave higher results than the combustion method, it was fully proved that there was no error in the latter, but that there was present either much tarry matter or bases which retained sulphur in combustion:—

	I.	II.	III.	IV.
A	48·34	45·31	45·46	45·28
B	52·76	51·50	51·70	51·58
C	58·84	58·60	58·76	58·81
D	42·96	41·70	41·70	41·90
E	48·46	48·29	48·33	48·14
F	49·87	49·04	49·11	48·98
G	62·38	60·12	59·96	60·22
H	54·77	51·71	51·50	51·60

The numbers in column I. are by bisulphide of carbon; in columns II. and III. are numbers obtained by the combustion method as before described; and in column IV. numbers obtained by the combustion of sulphur; but the sulphur dioxide was passed into hydroxyl, and the sulphuric acid weighed as barium sulphate.

It has often been said that the anhydrous oxide of iron will not take up sulphur from coal gas. To show that this notion is erroneous is given an analysis of spent oxide produced by mixing burnt pyrites after the extraction of the copper with sawdust, and placing in the purifiers in the usual way. The oxide had been in use in a small gas-works for nearly twelve months:—

Ferric hydrate	6·28
Ammonium sulphocyanide	1·56
Ammonium chloride	0·72
Tarry matters	1·00
Moisture	16·40
Insoluble in dilute HCl	35·50
Sulphur	34·00
Sawdust, &c. (by difference)	4·54
Total	100·00

In conclusion, I may add that the sulphur must be determined, if by this combustion method, in the *washed* and *dried* sample; the raw original sample must on no account be used, for when the raw sample is operated upon no two results can be made to agree; for, in the first place, there are present sulphates, sulphocyanides, and ferrocyanides, which are acted upon in different manners as the air current is more or less rapid, and the heat of the combustion-tube more or less intense. The sulphate of ammonia may be split up and form sulphur dioxide, or it may be simply volatilized, or both conditions may coexist and incorrect results will be obtained. Neither is it of any use to aspirate the products of combustion through a solution of carbonate or caustic soda, titrating afterwards the sulphur dioxide with decinormal iodine, for more than 90 per cent. is by this means oxidized to sulphuric acid; and though this may be precipitated and weighed as barium sulphate, yet this is a much longer method, more tedious, and not more accurate; so that for all technical purposes where the amount of *available* sulphur is required, the only process at once rapid, easy, and accurate is the method of combustion as given above, burning the sulphur into sulphur dioxide, absorbing this in decinormal iodine largely diluted with water, and titrating the excess of iodine solution with decinormal hyposulphite.

OSSETT GAS COMPANY AND THE LOCAL BOARD.

At the Meeting of the Ossett Local Board on Monday, the 12th inst.—Mr. E. Mitchell in the chair,

Mr. Terry submitted a resolution to the effect that the board should cease to light the whole of the public lamps in the district, and thereby throw the town into darkness, until the gas company consented to lay mains in Low Lane. [We gather from a local paper what we suppose may be the ground for so extraordinary a proposal. It seems that the gas company have frequently been requested to lay gas-mains in Low Lane, but as there are only a limited number of houses in that locality, the company have declined to accede to the request, because they do not think the profit arising from the consumption of gas would be sufficient to pay the interest on the outlay which they would have to incur in laying the mains.] In support of his resolution Mr. Terry said that, about a year and a half ago, the board resolved that the gas company should be requested to lay mains in the district referred to. A deputation from the

board waited upon the directors of the gas company, and they agreed to lay the mains if the local board would pay half the cost. The board refused to agree to that proposal, and the question had remained in an unsettled state up to the present time. There were 40 houses in the lane, and although the occupiers of them had to pay rates for lighting, they had no public lamps within a considerable distance. He did not think this was a state of things which should be allowed to exist any longer, and he considered that they ought to throw the whole of the town into darkness before they permitted the gas company to be masters of the local board. He also thought that if the company would not lay the mains, the board ought to apply to Parliament for an Act giving them power to purchase the gas-works, or establish other works, and get rid of the monopoly. He had spoken to several persons on the subject, and they agreed with the course he was taking in the matter. He believed that when the gas company saw the board were really in earnest, they would do the work.

Mr. MEGSON said that he would gladly have seconded Mr. Terry's motion but for one reason. Whilst the sewerage works were proceeding, it was very desirable they should have the streets lighted, and he did not see his way clear to cut off the gas and so be in darkness at the present time.

Mr. TERRY said the large dividends paid by the gas company would be reduced if the board discontinued to light the streets, but the chairman assured him that the gas company could keep up their dividend if there was not a single public lamp in the district.

Mr. ELLIS asked the board if they were to sit down and see one part of the town trodden upon and trampled down by a monopoly? He thought they should see justice done to the suffering ratepayers, who were in darkness, and not allow them to be trodden and trampled upon any longer. It was to the interest of the town at large that gas-mains should be laid in the district referred to, and it was the duty of the board to do all they could for the ratepayers, who complained of the want of light. If the gas company now refused to lay mains in one of the most important public highways in the district, he thought the board should go in and buy the gas company's plant if the company would sell it, and if they would not sell it, then he, for one, would go in for stronger measures, and either apply for an Act of Parliament, or by resolution not only cut off the whole of the public lamps, but, as far as they could, induce the private consumers to cease to burn gas until the gas company complied with their request. If the board came down upon the gas company in earnest, he believed they would get what the wanted.

Mr. SMITH seconded Mr. Terry's motion, and in doing so said he believed the gas company were quite willing to sell their works to the board.

Mr. CLAY said he had great sympathy with his friend Mr. Terry, but he did not see his way to support his motion. Two wrongs did not make one right, and he thought if they discontinued the lighting of the streets at the present time it would be attended with considerable danger. He believed it would be possible to induce the company to extend their mains as desired, and therefore he suggested that a deputation from the board should wait upon the gas company, and again request them to lay mains in the district.

Mr. SIMPSON proposed an amendment in accordance with Mr. Clay's suggestion, and said that after the strong language which had been used by some of the members of the board that evening, he had faint hopes that the gas company would accede to the repeated request of the board.

Mr. ELLIS seconded the amendment.

After some further discussion, Mr. TERRY replied upon it, and in doing so he remarked that the shares in the gas company had become so valuable that a short time ago he tried hard to purchase four; but, although he bid a very good price, another person offered £1 per share more, and got them.

Mr. SIMPSON: You would not have brought forward your motion, I should think, if you had got the four shares.

Mr. TERRY: Yes; I should have brought it if I had had five times four shares.

The question was then put to the vote, when the numbers were equal; but on being put again the amendment was carried.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

At most of the local iron-works there is no great amount of work in hand, but at several of them a moderate business is being done, and although the aggregate production is not heavy, still the individual output is encouraging, and serves to keep matters going until more prosperous times shall set in. It is true that several establishments are poorly engaged in every respect, but there are reasons for this state of things, which are easily understood, and it may reasonably be anticipated that most of the weaker concerns will go to the wall before the much looked-for revival takes place.

In raw materials there is nothing special doing, ores being rather cheaper now that the smelters are united in making the effort to keep the production of pig iron as low as possible. For the same reason prices of pig are, for the most part, purely nominal, and even some of the Bessemer brands are 2s. to 2s. 6d. per ton cheaper. North Yorkshire general quotations are now as under:—No. 1 foundry, 43s.; No. 2 foundry, 42s.; No. 3 foundry, 40s.; No. 4 foundry, 39s.; No. 4 forge, 38s. 6d.; mottled, 38s.; white, 37s.; refined metal, 57s.; Kentledge, 42s. 6d.; and cinder pig, 35s.—all for net cash, f.o.r. Leeds, "Aireside," No. 1, 51s.; No. 2, 47s. 6d.; No. 3, 46s.; No. 4, 45s.; forge, 44s.; M, 43s.; and W, 42s. 6d. "Acklam, Yorkshire," No. 1, 44s. 6d.; No. 2, 42s. 6d.; No. 3, 40s. 6d.; forge, 39s.; and M, nominal. Good Derbyshire and South Yorkshire foundry pigs range from £2 10s. to £2 17s. 6d., according to brand, but large lots even in these can be obtained on "special" terms, which may safely be inferred to be lower than those quoted for small lots or in ordinary transactions. There is a fair call for Renishaw, Clay Cross, Sheepbridge, Denby, Butterley, and Thorncliffe brands. Most of the larger foundries remain tolerably well employed on the classes of goods recently mentioned here.

The demand for house coal is only on a medium scale, either in Derbyshire or Yorkshire, although some of the metropolitan buyers are evidently getting together considerable stocks, in anticipation of severer weather shortly setting in. The late advance in prices has only been indifferently maintained, and merchants state that they cannot hope to secure orders at higher quotations in the face of the excessive competition which now prevails. The same remarks apply equally to engine fuel, but in steam and gas coals there is an organization which prevents prices from being forced too low. The opening of new collieries continues apace, and there are works in course of execution in various places which must shortly raise the output of the district by several million tons annually.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The demand for all descriptions of fuel, except the better classes of round coal suitable for house fire purposes, continues very dull, and even in the house coal trade there is still an absence of that briskness which is usual at this time of the year. It is only in exceptional cases that colliery proprietors are fully supplied with orders, and generally, although late rates for best coal are maintained, higher prices are not obtainable, whilst for orders in bulk low figures are still taken. Common coal continues very difficult to move, and, owing to the great scarcity of orders, some of the common coal collieries are being put on short time. Burgy is still plentiful in the market, but in some quarters this class of fuel is said to be selling moderately well. Slack appears to be getting more abundant in the market every week, and as stocks accumulate there are sellers at lower prices. The average quotations at the pit mouth may be given at 10s. to 11s. per ton for good Arley; 8s. to 8s. 6d. for Pemberton four-feet; 5s. 9d. to 6s. 6d. for common coal; 4s. 9d. to 5s. 3d. for burgy; and 3s. to 3s. 6d. for ordinary slack; but so far as the inferior descriptions of fuel are concerned, it is difficult to name any fixed price, and slack in quantities has been sold at as low as 2s. 6d. per ton at the pit.

The demand for shipping purposes continues very small, with prices extremely low.

In the iron trade there is only a small hand-to-mouth business doing either in raw or finished iron, and works all through the district are extremely short of orders; in fact, it was publicly stated last week, by the manager of one of the largest engineering establishments in Manchester, employing usually nearly 1500 men, that two months back the firm had not a single order left on their books, and it was only the arrival of a Government order for the Indian State railways that prevented them closing their doors altogether for a time. So far as prices in the pig iron market are concerned, local makers are still firm at late rates; but in finished iron, although the current list quotations are without change, there is a tendency towards weakness, and north country bars delivered into this district are offered at rather less money, Lancashire bars being now quoted at £6 7s. 6d. to £6 10s. 2d.; Middlesbrough do. at £6 5s. to £6 7s. 6d. per ton.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The coal trade was not quite so good last week. It was rather duller all round. The demand for gas coals was very well maintained, however, especially for best. The best and medium gas collieries are working full time. They are likely to do so until after Christmas at least. Prices are unchanged for all sorts. The house coal trade is steady at recent quotations. The demand for steam coals is weaker. Best steam coals are quoted at little more than 10s. per ton; medium and second-class coals do not realize more than from 9s. to 9s. 6d. per ton, and some sorts do not exceed from 8s. to 8s. 6d. per ton. The present condition of the steam coal trade, and the poor local demand for manufacturing coals, are sure to have a depressing effect upon all other kinds of second-class coals during the winter. The Northumberland steam collieries are working very badly. A number of pitmen are out of employment.

The freight market is absolutely unchanged. From 4s. 9d. to 5s. per ton for steamers, and from 6s. 4½d. to 6s. 6d. per ton for sailing ships, are likely to be the current rates to London for the winter. The quotations for sailing ships at present are—London, 6s. 6½d., Yarmouth, 5s. per ton; France, £8 10s. to £8 12s. 6d. per keel. A few more steamers have taken out part cargoes of coals. To Boston coal is mostly taken for ballasting, to steady the vessels in the Atlantic; and it is a singular thing to record, but it is nevertheless true, steamers have chartered to load coals for Boston, U.S., at one shilling a ton less than they would have taken them to London, and, according to the latest quotation, at 2s. 6½d. per ton less freight than gas coals are delivered by sailing vessels at the wharves in London river. Some of the last boats have loaded out coals to America at freights just sixpence per ton more than is paid the United States Government for protective duty.

The iron trade of the North of England is without change. There was a quiet market in Middlesbrough last week. In the manufactured iron trade. There is nothing new to report. Steel works are being extended in the Cleveland district. The chemical trade of the North is extremely dull.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the Town Council of Rothesay, held last week, it was resolved to reduce the price of gas by 5d. per 1000 cubic feet, the price for the ensuing year being 5s. Had it not been that there is a prospect of having to lay about two miles of a new mains for the convenience of the adjoining watering-place of Port Bannatyne, it is likely that the reduction would have been greater. Not only is the price of gas now very low in the first instance, when compared with that in towns somewhat similarly situated, but the consumers can claim another pecuniary advantage in respect of their discounts—5 per cent. on accounts of £20 and upwards per annum; 4 per cent. on accounts from £10 up to £20; and 2½ per cent. on accounts under £10. Some notion may be formed of the quality of the Rothesay gas, when it is mentioned that the mixture is produced from Orchard Lesmahagow coal, two retorts; Shieldmuir, two retorts; and Glengarnock, ten retorts. During the year ending the 1st of October, the street-mains were extended 2530 yards, and one of the gasholders was telescoped.

The Alloa Gas Company have thought fit to remember in a very substantial manner the faithful and valuable services of their manager, Mr. George Boyd, prior to handing over their works formally to the Burgh Commissioners. They last week unanimously agreed to give him a retiring *douceur* of £250, which is to be paid to him from the interest payable to the company from the 29th of June last, the date at which the works were to become the property of the commissioners. It seems that the arbitrators have not yet (or, at all events, *had* not up to a few days ago) sent in their award; and, in the meantime, the company are carrying on the works for the behoof of the corporation, which they will do till the final settlement—that is to say, till the deed is handed over and the cash paid. Mr. Boyd is certainly to be congratulated upon having merited and received such a marked recognition of his services.

On Monday, the 12th inst., the members of what are known as the Nine Trades of Dundee met for the purpose of electing two members of the Gas Commission. In bringing the business to a close, the convener (Mr. James Mitchell) said he had experience for one year as a Gas Commissioner, and he could bear testimony to all that had been said in favour of the commission. The works were in a very efficient state, and Dundee was highly benefited by Mr. M'Crae's experience and skill. The cost of the gas-works, when taken over by the town from the two companies, was paid by issuing annuities. Under the Acts of 1868 and 1872, £100,000 had been borrowed. That sum was now expended, and the commissioners had taken power in their last Act to borrow another £100,000, and of that sum £6000 had already been called up. They had experienced no lack of money, and had opened their coffers to receive small sums from the general public.

At the monthly meeting of the Broughty Ferry Police Commissioners, held on the 12th inst., it was reported that the average illuminating power of the gas supplied to the burgh during the preceding month was 30·13 candles.

During the week ending Nov. 10, Dr. Wallace found the illuminating power of the Glasgow gas very low at three of the testing stations—25·27 candles at one, 25·15 at another, and 25·03 at the third. Even the average at one station was only 25·98 candles, or less than one candle over the minimum stipulated for by the Glasgow Gas Act. The maximum ranged from 26·81 candles to 29·07 candles.

At a special meeting of the Inverness Police Commissioners recently held, a joint report of the Water and Gas Committee and the Finance Committee recommended the election of Mr. Dallas, town-clerk, as clerk under the Act, and the appointment of Mr. A. P. Hay, town chamberlain, as treasurer. The recommendations were agreed to, and it was resolved not to fix the salaries in the meantime. The clerk was instructed to obtain from the manager of the old gas and water company all the books and documents which belong to them, and which may be considered necessary to the economic management of the works of the corporation.

The Gas Committee of the Town Council of Hamilton have been reconstituted. Mr. Tainsh, who has so long been the convener of the committee, declined to act, and the post which he held has been filled by the appointment of Bailie Cassels. Mr. Tainsh has hitherto devoted a large amount of time and attention to gas affairs in Hamilton, and has been very diligent in seeing that the Aitken-Young process has had a fair trial.

On Monday of last week the new gravitation water-works for Campbeltown were formally opened. Specially intended for the supply of the Dalintober district, they are situated about a mile and half to the west of the town, and are 240 feet above the level of the sea, giving a pressure of 80 lbs. Mr. William Crouch, C.E., Glasgow, engineer for the burgh, designed the whole works, and Mr. John M'Kirdy, C.E., Glasgow, was the resident engineer. The total cost is estimated to be close upon £5000.

The Burntisland Town Council paid an official visit last Wednesday to their new water-works at the source of the Dour. The works have been in progress for ten months, and may be said to be half completed. The scheme is expected to cost £25,000, instead of £18,000, as at first anticipated, but the success of the undertaking is felt to be undoubted.

The rainfall during the month of October at Greenock, proverbially one of the wettest towns in Scotland, was 10·41 inches, as compared with 7·59 inches in the corresponding month last year. There were ten dry days during the month, as compared with eleven in the same month last year. The heaviest fall of rain in one day took place on the 21st, when 1·82 inches fell, and in October last year the heaviest fall was on the 18th, when it amounted to 1·27 inches. The rainfall at Jedburgh during the month of October was 3·72 inches, while that for the corresponding month last year was 2·06 inches, and the monthly average for October during the thirteen preceding years was 2·56 inches. From the 1st of January to the 6th of November of the present year, the rainfall at Glencorse (Edinburgh water supply works) was 47·70 inches, as compared with 36·05 inches in the same period in 1876, and 29·25 inches in 1875.

It is stated that there is a prospect of the water-rate at Rothesay being raised 25 per cent. Rothesay is one of the very few towns where the water supply is still in the hands of a private company.

The Glasgow pig iron warrant market opened dull last week, and the price rapidly receded until 52s. was reached, from which it has scarcely varied. The fall over the week was 7d. per ton. It has been resolved by the Scotch ironmasters to continue the low rate of production for another three months, the number of blast furnaces in operation being 88, as against 117 at the same time last year.

It cannot be said that the coal trade has in any way improved. All descriptions are slow of sale, and coalmasters with a large output are much exercised to get a market for their daily out-turn. Prices have not advanced.

Dewsbury, Batley, and Heckmondwike Water-Works Arbitration.—On Tuesday, the 13th inst., this arbitration case commenced. The question to be decided is the amount that the Corporations of Dewsbury and Heckmondwike shall pay to the Corporation of Batley for their share of the water-works undertaking. The arbitrators are—for Dewsbury and Heckmondwike, Dr. Pole; and for Batley, Mr. T. Hawksley. The umpire is Sir H. Hunt, C.B. Sir H. James, Q.C., and Mr. Shaw are counsel for the Batley Corporation; Mr. Pope, Q.C., and Mr. Michael for the other parties. The Court sat until Thursday afternoon, and then adjourned until the 13th proximo.

Castleford Gas Supply.—A special meeting of the Castleford Local Board of Health was held on the 15th inst., for the purpose of considering, and, if so determined, adopting a resolution authorizing the board to promote a Bill in Parliament for the purpose of constructing gas-works to supply Castleford and surrounding districts with gas, and to acquire by compulsion or otherwise the Castleford and Whitwood Gaslight and Coke Company, Limited. Mr. Hamson, the chairman, moved a resolution embodying the above. Dr. Horne seconded the motion. Mr. M'Vay protested that the meeting was illegal, and moved an amendment to the effect that the proposed application to Parliament be not made. In the course of a long speech he pointed out that Castleford was in debt to the extent of £54,635, or within £7000 of its full borrowing powers, and contended, in the face of the present depressed state of trade, that the proposal was inopportune. He further pointed out that the costs of the application to Parliament—which might amount to anything between £500 and £2000, and in all likelihood the attempt would prove abortive—would have to come out of the ensuing year's district rate, and might entail a rate of 10s. in the pound, in addition to the rate for the current expenses. The amendment was lost by five votes to two, and the original motion was adopted.

Purchase of the Weston-super-Mare Water-Works.—At a special meeting of the Weston Town Commissioners, on Wednesday last, the minutes of a committee of the whole board in reference to the above question were read, and after some discussion the following resolutions were adopted:—"That it is expedient that the commissioners promote in the ensuing sesion of Parliament a Bill for authorizing them to purchase the undertaking of the Weston-super-Mare Water-Works Company, and to supply their district with water, and for other purposes connected therewith; and that the expense in relation to the promotion of the said Bill be charged on the general district rate." Also "That the sum of £65,000 be paid by the commissioners to the water-works company at the expiration of 60 years from the passing of the Act, and to be secured by bonds. That the committee shall at the expiration of seven years from the passing of the Act make provision for paying off the bonds, either by instalments or by means of a sinking-fund, appropriated and invested in such securities as trustees are by law authorized to invest trust moneys, and the accumulations thereof, if any, from time to time be applied for that purpose, so as to pay off the whole of the bonds within the 60 years of the passing of the Act. That the commissioners shall have the option of paying off the bonds at any time, on giving six months previous notice in writing to the holders thereof." It was stated that the whole of the preliminaries for the proposed purchase are now complete, and will be submitted to a public meeting of the ratepayers to-morrow.

Coal-Gas Poisoning.—At the meeting of the Edinburgh Medico-Chirurgical Society on the 7th inst., Dr. James Young communicated a paper by Dr. M'Bain, of North Berwick, on a "Case of Coal-Gas Poisoning." The case was that of a lady fifty years of age, who was without sense of smell, and who, on retiring to rest at midnight one evening in January last, had opened the tap of the gas, after having extinguished it, by turning it too far round, the gas-pipe not being provided with a proper stopper. The bed-room was 9 feet by 9 feet, and contained no fireplace. About eight o'clock next morning she was discovered lying in bed insensible, and the room was filled with gas. The window was opened, and Dr. M'Bain arrived about half an hour afterwards. He found her lying in bed on the left side, breathing stertorously, with face swollen, eyes closed, pupils semi-dilated, lips red and natural, jaws fixed, other parts flaccid; pulse small, weak, and beating 110 per minute. Her breath smelt of gas, and she was passing her urine involuntarily in bed. She was removed to a large bed-room, with plenty of fresh air, and wrapped in blankets. With the view of acting on the skin, Dr. M'Bain, by means of ten or twelve bottles filled with hot water, and enclosed in stockings wrung out of hot water, produced a vapour bath around the patient. This caused her to perspire freely. Towards evening she began to improve, and ultimately made a good recovery.—Dr. Watson referred to the rare occurence of poisoning by coal gas, considering the extent to which that gas was used for cooking, lighting, and heating purposes. He mentioned a case in which an old lady and a niece had been poisoned with gas. The niece recovered, whilst the old lady died. Professor Spence referred to the case recorded by Dr. Taylor two years ago, in which the patient died forty-eight hours after the accident. Dr. Argyll Robertson said that he was anxious to know if any smell of gas appeared in the perspiration. Dr. Buist mentioned that in manufacturing districts he had frequently seen cases of poisoning when the men were cleaning out the tubes. The treatment was plenty of fresh air. He had met with one fatal case.—*Medical Examiner.*

Gas and Water Supply of Altrincham and Bowdon.—Strenuous attempts are being made by a large number of influential ratepayers in Altrincham and Bowdon to induce the Altrincham and Bowdon Local Boards to acquire the works of the Altrincham Gas Company and those of the North Cheshire Water Company, which companies supply these neighbourhoods with gas and water. The purchase of the gas-works would necessitate an expenditure of something like £100,000, but the value of the water company's works has not been computed. In reply to a deputation of Bowdon gentlemen, the Bowdon Local Board have expressed themselves favourable to the proposed purchase, and at the meeting of the Altrincham Local Board, Messrs. Robinson, Scotter, and Trenbath attended as a deputation, and submitted the following memorial, which was extensively signed:—"The ratepayers of Altrincham having just cause of complaint in consequence of the inadequate supply of water and the quality and supply of gas, and believing it would be to the great advantage of the inhabitants generally for the supply of such water and gas to be under the direct control of the local boards, respectfully request that you will take the subject into your early consideration, with a view joint action being taken by your board and Bowdon Local Board to acquire possession of the undertakings of the gas and water companies, and thus ensure an efficient supply of good, pure, and cheap gas and water to the residents of Bowdon and Altrincham." The deputation warmly advocated the purchase, and pointed out the immense profits derived from the gas-works in Manchester. Mr. J. Ambler stated that he and others had taken a great interest in the matter, and five years ago he moved a resolution that the board purchase the gas-works. The gas company then wanted £54,000 for their works, and the board were prepared to give £52,000. At that time they made several representations to the Bowdon Local Board, but they declined to co-operate in the matter. If they had purchased the gas-works then they would have saved the town £30,000. The Altrincham Local Board had been fully alive to the importance of the matter, and had tried every means in their power to conclude the purchase. The chairman (Mr. Gaskarth) said that they had never found the Bowdon Local Board disposed to co-operate with them, and he was afraid they would be indisposed to combine with them in a scheme involving an expenditure of from one to two hundred thousand pounds. He refuted the charge that the gas was of inferior quality, and maintained that the price—4s. 6d. per 1000—compared favourably with that charged in similar towns. After a long discussion, in the course of which the water supply of Bowdon was declared to be insufficient, the chairman of the board informed the deputation that they would communicate with the Bowdon Local Board, although they might be of opinion that it would not be of any use. The deputation thanked the board, and withdrew.—*Warrington Examiner.*

Register of New Patents.

2472.—Blamires, T. H., Huddersfield, "*New or improved means and apparatus for automatically opening and closing taps, valves, ventilators, and other similar purposes.*" Provisional protection only obtained. Dated June 14, 1876.

This invention consists in enclosing within suitable apparatus mercury, water, oil, alcohol, or other non-compressible fluid, or a combination thereof, which change their volume according to temperature. It is proposed to apply one or other of these fluids, or a combination thereof, as a power for automatically controlling the flow of hot or cold water or other liquids, air, or gas, for the purpose of regulating the temperature of various liquids or fluids, extinguishing fires, or other purposes, which can be effected by the opening or closing of taps or valves.

The apparatus may consist of a reservoir to contain the fluid, terminating at one end in a cylinder, so that as the fluid expands or contracts by the increase or decrease of heat it may be caused to act on a flexible disc or plate of metal or other elastic substance fixed on the cylinder, or within a curved pipe or tube, which is caused to straighten by the expansion, or curve by the contraction of the fluids, in the same manner as the "Bourdon" steam-gauge is affected by the increased or decreased pressure of steam, and thus to actuate the lever or levers for opening and closing taps, valves, &c.

2474.—Smith, F., South Hackney, London, "*An improved union or coupling for the connection of metal or other pipes, cocks, or valves.*" Provisional protection only obtained. Dated June 15, 1876.

This invention consists in a method of constructing unions or couplings for connecting metal, leather, india-rubber, or other pipes, cocks, and valves, in such a manner as to prevent their destruction by tension or twisting of the pipes, cocks, or valves. This object is effected by making the ends of the unions or couplings with one or more projections or serrations on the sides or face, so as to fit into holes or serrations of a corresponding form in the other part of the union or coupling.

2476.—Kramme, C. D. E., Berlin, "*Improvements in suspending gaseliers, chandeliers, and other lamps.*" Provisional protection only obtained. Dated June 15, 1876.

This invention has for its object the dispensing with the use of the counterbalance weights hitherto generally employed with gaseliers, &c., and the machinery and apparatus necessary therefor.

For this purpose, to the ordinary metal socket or base piece that is

fixed in the ceiling, is attached a tube, which may screw into the socket piece in the ordinary manner, or be attached thereto in any convenient way. This tube is furnished in its interior with a rack and pinion bar of a corresponding length to the tube itself, made of steel, and firmly screwed or welded to the tube. Within the first tube is a second or moveable tube or pipe, to the lower end of which is attached the gaselier. This moveable tube or pipe is tightened by means of a stuffing-box conveniently placed towards its lower extremity, and on the exterior towards the top is fixed a clutch which catches into the rack and pinion. In order to ensure this clutch so catching into the bar, the internal moveable tube or pipe is also provided on its exterior, towards the top, with a spiral spring, which by means of a hook enters behind the rack and pinion bar, and forces the clutch to gear into and firmly hold the bar.

To raise or lower the gaselier it is only necessary to slightly lift it, thereby dislodging the tooth of the clutch from the rack and pinion bar; then turn it a little towards the right, and bring it to the desired level, after which the gaselier may be permitted to drop, when the spiral spring expending forces the clutch to gear into the rack and pinion bar, thus suspending the gaselier in the desired position.

To prevent all risk of the spiral spring breaking when the internal moveable pipe is being turned round, a small metal projection is either formed thereon or fastened thereto near the top, which coming in contact with the rack and pinion bar thus effectually prevents the internal moveable pipe revolving too far, while conveniently placed on the exterior of the pipe are two other small projections or pieces, which serve as guides to retain the internal moveable pipe in a proper position within the external or outer tube.

2489.—Plessner, J. M., Golden Square, London "*Improvements in the construction and arrangement of water or liquid meters.*" Provisional protection only obtained. Dated June 15, 1876.

This invention consists of two vessels, surmounted each by another vessel, the four capacities being in communication, by passages through taps in the connection pieces, and also by pipes through other passages in the same taps from opposite sides for the flow of liquid. The taps are opened and closed by an oscillatory or pendulous motion of the whole apparatus by the alternate inflow and outflow of the liquid, the taps being acted upon by levers attached to a fixed framing between or on which the apparatus is suspended. The lower or measuring vessels have at their lower ends two outlet-pipes, which meet and have a tap common to both, which is also acted upon by a lever or levers attached to the same framing. This latter tap is not only the outflow tap for the discharge of the liquid from each vessel alternately, but it also serves as the inlet tap for the main supply to the apparatus, the tap plug having side openings to permit the inflowing liquid to pass them alternately to recharge the vessels. The charging orifices of the tap plug are of smaller area than the outflowing orifices, so that it occupies a longer time to fill the vessel than to empty the neighbouring one, the apparatus at the end of each oscillation being retained by a slip catch until the weight of the liquid, both of the completely filled measuring and its partly filled upper vessel, overcomes the weight of a counterpoise on a lever which carries the catch. The taps in the connection pieces between the two superposed vessels have each three passages, one uniting both vessels, another uniting the lower vessel with the upper neighbouring vessel, and the third for admitting the atmosphere into the measuring vessel to break the vacuum when this vessel is discharging.

The apparatus is intended to be fitted to a cistern or tank from which the water will be withdrawn. The water in this cistern or tank is kept at a constant level by a float, the sinking of which opens a tap in the main pipe through which the water flows into the meter, and is discharged according to the capacities of the measuring vessels, the oscillation being registered by a tell-tale or counter of ordinary construction.

2497.—Tylor, A., Newgate Street, London, "*Improvements in apparatus and arrangements for controlling, regulating, and arresting the supply of water for sanitary, domestic, and other uses, and preventing waste.*" Patent dated June 16, 1876.

This invention relates to that class of apparatus known as water-waste preventers and hydrants for controlling the supply of water, and has for its object improvements in the valves and apparatus patented by the present inventor from the year 1870, and consists in simplifying and improving the submerged "Waste-not valves" described in those patents; in arranging the ordinary round closet-valve and spindle-valve to act as "Waste-nots," and making the same more readily applicable to this use; in improving the London closet-valve, described in patent No. 1579 of 1873, so as to simplify its construction, and render it more convenient in use; and arranging hydrants so as to allow the valve, or part used to turn the water on and off, to be readily removed without emptying the pipes to which it is attached, or allowing the water to be wasted.

2501.—Colls, F. W., Erith, "*Improvements in the manufacture of gas for heating and lighting, and in the apparatus to be employed therein.*" Provisional protection only obtained. Dated June 16, 1876.

This invention relates to certain improvements on patent No. 1533 of 1873, the object being to produce gas from chalk or carbonate of lime in combination with superheated steam and hydrocarbon or other oil or spirit, and coke or charcoal or other carbonaceous materials, and in some instances metal.

It is proposed to use gas-retorts, either vertical or horizontal, one of which is to be charged with chalk or limestone, and a second or carburetting retort, is to be charged with charcoal or coke or any other carbonaceous materials, and the two retorts are to be connected by a suitable pipe. In some instances a third retort may be used, through which the combined gases are passed.

At a short distance from the retorts, a tank or reservoir containing hydrocarbon or other oil or spirit is fixed, and connected by a pipe with one of the gas-retorts. A syphon-gauge is to be applied to the tank to regulate the supply, and another pipe is connected with one of the retorts to supply superheated steam to it. An outlet-pipe from the carbon retort is connected to the chamber, and thence to the gasholder.

Heat is applied to the retorts by means of furnaces, and when it is sufficiently high, a small stream of oil or spirit is supplied to the retort, at the same time, superheated steam is admitted, and the exhauster put into action.

The result is as follows:—The oil or spirit with the superheated steam, in passing through the retorts, with the carbonic acid generated from the chalk, becomes decomposed; the carbonic acid is converted into carbonic oxide, and the steam into hydrogen; the whole combined being carburetted hydrogen and carbonic oxide gas of a high illuminating power, and free from sulphur and ammonia impurities.

When coal is used for gas-making by the usual process, as soon as the illuminating gas is exhausted and non-illuminating gas is made, superheated steam and hydrocarbon oil, or other oil or spirit, is caused to pass into one of the retorts, which is to be connected with a second retort and sometimes with a third.

In practice, the inventor constructs a furnace with a bench of retorts two or three retorts being connected with each as required) to be supplied with chalk or carbonate of lime, and carbonaceous materials or metal respectively, the retorts being constructed so as to afford the greatest possible amount of heating surface. Near the retorts a boiler is fixed, in which steam is generated, and a pipe therefrom is connected to a superheating apparatus set in a furnace, the steam from which is conveyed by tubes into the retorts, which being charged are separately connected to a main which conveys the products to an exhauster and condenser and purifier, and thence to the gasholder. The superheated steam enters the retorts by means of a pipe, and passes through or over the carbonaceous matters, and is converted into carbonic oxide and hydrogen gas.

2513.—Ewart, G., Euston Road, London, "*Improvements in gas heating apparatus.*" Patent dated June 17, 1876.

This invention has reference to the prevention of explosion in gas heating apparatus. As ordinarily made the air is allowed to mix with the gas from the moment it is turned on, and this causes the explosion.

These improvements consist in an automatic arrangement of mechanism, by means of which the atmosphere is excluded before either lighting or extinguishing the flame. The gas-burners used to heat bath-boilers and other vessels are usually constructed so as to be withdrawn from under the vessel in order to light or extinguish the gas in the open air. For this purpose the burner may be arranged upon ways, telescopic or otherwise, to be slid in and out, or upon a swivelling arm or otherwise. This movement of the burner in and out from under the vessel to be heated is taken advantage of to make it open and close suitable valves to either admit or exclude the atmosphere, excluding the air until after the gas is lighted, and also excluding it before the flame is extinguished, and admitting the air gradually, after the lighting of the gas, as the burner is being moved under the vessel.

APPLICATIONS FOR LETTERS PATENT.

4202.—Shorey, F. W., Poplar, London, "Improvements in valves." Partly a communication. Nov. 9, 1877.

4204.—Dalby, J., Ipswich, Suffolk, "Improvements in check or stop valves for controlling the supply of water to steam-boilers and other apparatus, and for similar purposes." Nov. 9, 1877.

4214.—Ashford, T., Birmingham, "Improvements in the manufacture of gas or tube hooks and holdfasts." Nov. 10, 1877.

4217.—Nawrocki, G. W. von, Berlin, Germany, "Improvements in meters for measuring liquids." A communication. Nov. 10, 1877.

4222.—Bangs, D. E., and Burnett, W., Boston, U.S.A., "Improvements in carburetters." Nov. 12, 1877.

4249.—Newton, H. E., Chancery Lane, London, "Improvements in gas-regulators." A communication. Nov. 13, 1877.

4252.—Vaughan, E. P. H., Chancery Lane, London, "Improvements in the production of combustible gases, and in the construction and arrangement of apparatus to be employed therefor." A communication. (Complete specification.) Nov. 14, 1877.

4269.—Stewart, A. and C., Glasgow, "Improvements in cocks and taps." Nov. 15, 1877.

4275.—Heinke, F. W., Twickenham, London, "Improvements in the method of and apparatus for obtaining or producing electric light." Nov. 15, 1877.

4282.—Asbury, C., Balsall Heath, Warwick, "Improvements in rotary pumps and motive-power engines." Partly a communication. Nov. 15, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1918.—Cort, J., Old Kent Road, London, "Improvements in the construc- of valves." May 16, 1877.

1954.—Gubbins, R. R., Upper Thames Street, London, "Improved apparatus for raising or forcing water, air, or other liquids or fluids." May 18, 1877.

2056.—Shanks, J., Renfrew, N.B., "Improvements in and connected with lavatories, baths, cisterns, water-closets, and other apparatus for the use of water." May 26, 1877.

3400.—Cozza, A., Orvietto, Italy, "An improved construction of tube coupling." Sept. 6, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

3792.—Fogarty, T. B., "Improved apparatus for carburetting air or other gaseous bodies." Nov. 3, 1874.

3807.—Johnson, J. H., "Improvements in apparatus for drawing or raising water or other liquids." Nov. 4, 1874.

3829.—Dodge, J., "Improvements in apparatus for exhausting or forcing air and gases." Nov. 6, 1874.

3843.—Marchant, R. M., "Improvements in the manufacture of gas." Nov. 7, 1874.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

2846.—Long, A., "Improvements in apparatus for controlling the passage of water or other fluids." Oct. 29, 1870.

NOTICE OF REMOVAL.

D. BRUCE PEEBLES & CO.

Beg to announce that they have REMOVED to their New Premises,

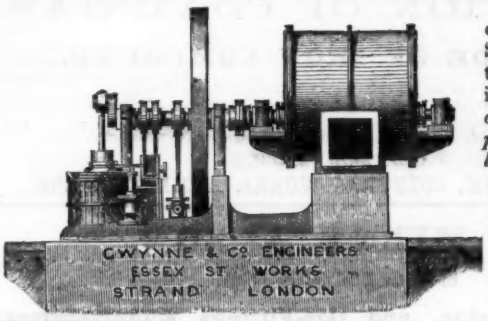
TAY WORKS, BONNINGTON, EDINBURGH,

To which all communications should now be addressed.

May 30, 1877.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS;
Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

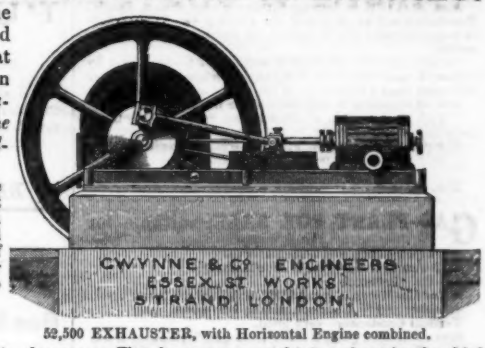
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure.
Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers,
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

☞ *G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.*

BOROUGH OF DERBY.

WANTED, a steady, active Man as FOREMAN of LAMPLIGHTERS; one who has filled a similar situation preferred. Wages 28s. per week.

Apply, in own handwriting, stating age and references, to CLEMENT DUNSCOMBE, Borough Engineer, DERBY.

WANTED, the Address of Gas Companies who have not received a Copy of the New Edition of PAMPHLET for GAS COMPANIES to distribute to their Gas Consumers—"Cooking and Heating by Gas." Price £6 for first thousand. Copies by post Threepence—direct from the Author, MAGNUS OHREN, Gas-Works, SYDENHAM, S.E.

WANTED, a Working Manager for a small Works. Must be able to lay mains, services, &c., and fix meters.

Applications, with testimonials and wages required, to be addressed No. 418, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

WANTED, an experienced Working MANAGER to take charge of a small Gas-Works, where the make is about four millions per annum. He must understand the setting of retorts, &c., and will be required to lay mains and services, and fix and index meters. House, coals, gas, water, and rates free.

Apply, on or before the 28th of November inst., with references as to character and ability, stating age, salary, and when at liberty, to the SECRETARY of the Gas-Works, Brampton, CUMBERLAND.

TO GAS STOKERS.

WANTED, a healthy, active Man as STOKER, in the Milton Gas-Works. He will be required to take a turn with another Stoker in lighting and extinguishing the public lamps. Wages 24s. per week.

Applications, enclosing testimonials of recent date as to character and fitness, should be addressed MANAGER, Gas-Works, MILTON-NEXT-SITTINGBOURNE.

WANTED immediately, at a Provincial Gas-Works, a thoroughly PRACTICAL DRAUGHTSMAN, competent to take Levels and prepare complete Plans and Specifications of new Gas-Works, Apparatus, &c.

Apply by letter, with copies of testimonials, and stating age, experience, and salary required, addressed to No. 419, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Young Man, the son of a Gas Engineer, a situation as ASSISTANT in a large Gas-Work, or as Manager of a smaller one. Is a good draughtsman, has a knowledge of chemistry, and is quite competent to take charge of a work. Can be well recommended.

Address No. 415, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a small Gas-Works at Hatfield, near Doncaster (Yorks), a WORKING MANAGER. Must be well up in the manufacture and distribution of gas, main and service laying, and all fittings in and out of the Works. House, garden, coal, and gas free.

Applications, stating wages required, accompanied with copy of recent testimonials, to be sent to me on or before the 1st day of December, 1877.

GEO. STONES, Secretary,
Hatfield, near DONCASTER.

WARRENPOINT GAS CONSUMERS COMPANY.

MANAGER wanted. Salary £60 per annum, with free residence, large garden, fuel, and light.

Application to be made not later than the 28th inst.

For particulars and duties apply to
JAMES COULSON, Secretary.

Nov. 9, 1877.

ON SALE—One Station-Meter, to pass 1000 cubic feet per hour. Almost new. Will be sold cheap.

Apply to J. HALL, Gas-Works, St. Helen's, LANCS.

BLACKPOOL CORPORATION GAS-WORKS.

TO BUILDERS AND IRONWORKERS.

THE Gas Committee are prepared to receive TENDERS for Contract No. 3—The erection of Retaining-Wall and Coal-Siding.

Contract No. 4—The whole of the Ironwork (about 38 tons) required for the above work.

Plans and specifications may be seen, and quantities obtained, at the Office of the undersigned.

Tenders to be endorsed and addressed to the Chairman of the Gas Committee, and sent in by Tuesday, the 27th of November next.

The lowest or any tender not necessarily accepted.

By order,
JOHN CHEW, Manager.

SHOTLEY BRIDGE AND CONSETT DISTRICT GAS COMPANY.

TAR FOR SALE.

THE Directors of the above Company are prepared to receive TENDERS for the TAR produced at their works for Twelve months, or such other term as may be agreed on, from Jan. 1, 1878.

The quantity at present made is about 35,000 gallons per annum.

Tenders, marked "Tar," to be sent to the undersigned not later than the 5th of December.

Any further information may be had on application.

By order,
M. RICHLEY, Secretary.

Nov. 8, 1877.

Now ready, price One Shilling, No. 12 (to be continued Monthly) of

A TREATISE ON THE SCIENCE & PRACTICE

OF THE

Manufacture and Distribution

OF

COAL GAS.

LONDON: WILLIAM B. KING, 11, BOLT COURT, FLEET STREET,
OR OF ANY BOOKSELLER IN TOWN OR COUNTRY.

For the convenience of persons resident in remote districts, arrangements have been made by the Publisher to forward the "Treatise" by Post, securely packed, at the cost of 1s. 2d. Monthly, or 7s. for the Half Year.

NOTICE.

THE GAS & WATER COMPANIES DIRECTORY, 1878.

(WATER SECTION.)

The Editor will feel greatly obliged if Secretaries and Engineers would fill up, and return to him at once, the forms sent them, as the work is now going to press. If any have not received Forms, they will be forwarded immediately, on application to the Editor,

CHARLES W. HASTINGS,
8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.

E. & W. H. HALEY,

General Ironfounders and Makers

OF

CAST-IRON GAS AND WATER PIPES.

Sizes 1¼ to 15 inches.

LISTER HILLS FOUNDRY, BRADFORD, YORKSHIRE.

BAHIA GAS COMPANY, LIMITED.

NOTICE is hereby given that the ORDINARY HALY-YEARLY GENERAL MEETING of this Company will be held at the Company's Office, 10, Coleman Street, London, on TUESDAY, the 27th day of November, 1877, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, and for general purposes.

And NOTICE is hereby further given that a Special Resolution will be proposed for altering the 77th Article of Association of the Company, by omitting therefrom the words:

"Until the sum of £20,000 authorized to be raised by clause 74 shall have been fully raised, without any further authority than a resolution of the Board of Directors."

And by inserting in lieu thereof the words:

"With the sanction of a resolution passed by the Company in General Meeting."

The chair will be taken at Three o'clock precisely.

By order of the Board,
ALFRED J. HEAD, Secretary.

Nov. 13, 1877.

GAS PLANT FOR SALE, suitable for Small Works:—

Seventeen 4-inch and 3-inch H-Pipes.
Eighteen 15-inch Circular Mouthpieces.
A 6-inch Governor.
A Station-Meter, to pass 6000 cubic feet per hour.
Scrubber and Washer combined; very good.
Vertical Condenser; very good.
Seven 7-feet lengths, 12-inch D-shaped Hydraulic Main.
Two Gasholders, each capable of holding 15,000 cubic feet.

Apply to the ENGINEER, Phœnix Gas Company, GREENWICH.

TO GASHOLDER MAKERS.

THE Directors of the Malton Gaslight and Coke Company invite TENDERS for the construction of the INNER LIFT of a Telescopic Gasholder, 85 ft. diameter by 20½ ft. deep.

Drawings and specifications may be seen at the Company's Offices, Malton, Yorkshire.

Tenders to be sent in on or before the 6th day of December, 1877, addressed to the Chairman and Directors of the Company, and endorsed "Tender for Gasholder."

The Directors do not bind themselves to accept the lowest or any tender.

HENRY TOBEY, Manager.

Malton, Nov. 15, 1877.

A GUIDE TO GAS LIGHTING, by ALFRED H. WOOD, A.I.C.E., Gas Engineer, Hastings.

"Full of sound, practical instruction for consumers, and is *an excellent book for Companies to circulate among their consumers.*"

Price, post free, from the Author:

One copy	£0 1 0
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MICHAEL & WILL'S GAS AND WATER SUPPLY.

This day is published, second edition, 8vo., 25s., cloth,

THE LAW RELATING TO GAS AND WATER: comprising the Rights and Duties, as well of Local Authorities as of Private Companies, in regard thereto, and including all Legislation to the close of the last Session of Parliament. Second Edition. By W. H. MICHAEL and J. SHIRESS WILL, of the Middle Temple, Esqs., Barristers-at-Law.

London: BUTTERWORTHS, 7, FLEET STREET, Her Majesty's Law Publishers.

REMOVAL.

CHARLES HEISCH, F.C.S., Analytical and Consulting Chemist, Superintending Gas Examiner to the Corporation of London, &c., &c., has REMOVED from 8, Savage Gardens, to 79, MARK LANE, where he may be consulted as usual.

TO GAS ENGINEERS, MANAGERS, &c.

HILL and CO., Gas Engineers and Architects, 11, Appach Road, BRIXTON RISE, S.W., prepare Designs for the construction of New Gas-Works, Bridges, and Roofs, or for the remodelling and extension of existing Works. Also provide Drawings of all kinds of Gas Apparatus and Plant. Drawings, Tracings, and Specifications copied for Engineers and Contractors.

TO GAS COMPANIES.

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CONSULTING GAS ENGINEER,
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34, ST. GEORGE'S ROAD, SOUTHWARK, S.E.
Reports and Valuations in the Management, Construction, and Structural Value of Gas-Works.

MOBBERLEY & PERRY,
FIRE CLAY and BRICK WORKS,
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Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAY.
Manufacturers for Home and Export.
GAS-RETORTS, GLASS-HOUSE FURNACE,
BLAST-FURNACE, TANK BRICKS, LUMPS, TILES,
And Every Description of Best Fire-Bricks.

GAS PURIFICATION.

BAILES & HALLSWORTH,
CONTRACTORS FOR THE
PURIFICATION OF COAL GAS,
BY THEIR
PATENT OXIDE OF IRON COMPOUND.

The material is in use at most of the principal Gas-Works in Yorkshire and elsewhere. It contains considerably less moisture than natural Oxide of Iron. It is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

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GAS ENGINEERS,
Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,
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Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,
And every description of Gas-Fittings and Gas Apparatus.

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IRONFOUNDERS AND CONTRACTORS,
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ESTIMATES FOR GAS-WORKS OF ANY SIZE.
REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

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MANUFACTURER OF
SQUARE STATION-METERS, with PLANED JOINTS;
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WET AND DRY CONSUMERS GAS-METERS, GOVERNORS, &c.

ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

For Jointing and Repairing Retorts and Ovens *in* action and *out* of action.

A Pamphlet on the advantages of the above, with modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

WILLIAM RICHARDSON, GAS AND HYDRAULIC ENGINEER,

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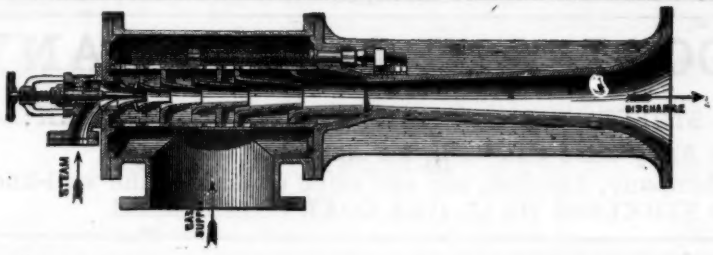

KÖRTING'S STEAM-JET GAS-EXHAUSTER.

IMPROVED CLELAND'S PATENT.

UPWARDS OF 250 IN USE.

CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

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17, LANCASTER AVENUE, MANCHESTER,

OR TO

GERALD J. TUPP, 8, John Street, Adelphi, W.C., LONDON,

SOLE AGENT FOR ENGLAND AND WALES.

J. & J. BRADDOCK,

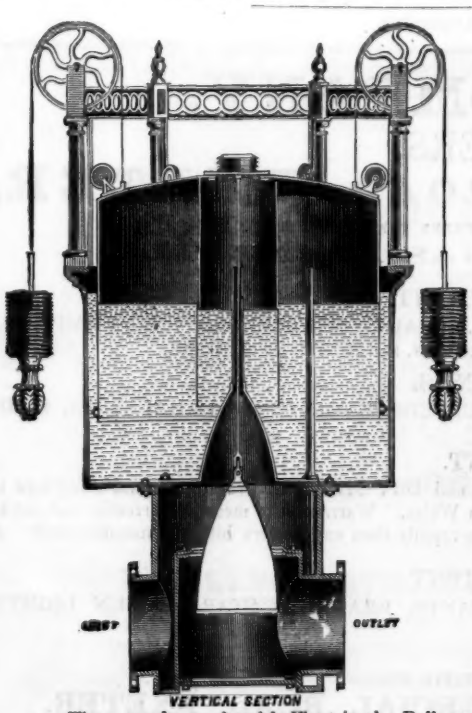
GLOBE METER-WORKS,

OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

GARSIDE'S IMPROVED MAIN DRILLING CLIP.

No. 1 takes from 2-in. to 6-in. Mains.
No. 2 takes from 6-in. to 12-in. Mains.

GARSIDE'S REGISTERED TUBE-VICE takes ¾ brass to a 2-in. Socket.

May be had direct from the maker, SAMUEL GARSIDE, Gatefield Iron-Works, ASHTON-UNDER-LYNE.

CATHELS'S Patent District Dry Gas-GOVERNOR

is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE

is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Improved Retort-Settings.

Guaranteed to heat and wear well, with great economy of Fuel.

Coloured lithograph copies of Working Drawings of Beds of One to Seven Retorts (so clearly arranged and fully shown as to be easily understood by any retort setter or bricklayer) having been made of these valuable settings, they can now be supplied with detailed Specification immediately on receipt of orders.

Apply to Mr. THOS. NEWBIGGING, Consulting Gas Engineer, 5, Norfolk Street, MANCHESTER.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,

SCOTSWOOD FIRE-BRICK WORKS,

SCOTSWOOD-ON-TYNE.

BOUCK & CO., LIMITED,

TAR DISTILLERS & MANUFACTURING CHEMISTS,

MILES PLATTING, MANCHESTER.

BUYERS OF COAL TAR,

And Crude Products therefrom,

AMMONIACAL LIQUOR, &c.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

MR. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

LAMBERT'S

CAST-IRON GAS-MAIN COCKS,

WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.

The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/0	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

MANUFACTORY:

SHORT STREET, LAMBETH, LONDON.

ALFRED LASS,
SPECIAL ACCOUNTANT FOR GAS COMPANIES,
30, GRACECHURCH STREET, LONDON.

Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.
The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved.
The above forms are registered.
Water Companies Accounts also prepared and adjusted.
CONSULTATIONS.

PATENT HYDRAULIC LIFTS, CRANES, HOISTS,
Suitable for Lifting Purifier-Covers, &c.
S. CLAYTON & CO., BRADFORD, YORKS.

THE WIGAN COAL & IRON COMPANY,
LIMITED.
DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;
Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.
N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

GAS PURIFICATION & CHEMICAL Co., LIMITED.
(Successors to JOHN WILLIAM O'NEILL & CO.,)
Offices—PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.,
CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.
The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.
JOHN WILLIAM O'NEILL, SAMUEL H. JOHNSON, } Joint Managing Directors.

FLETCHER AND MURPHY,
GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;
Manufacturers of
IMPROVED CONSUMERS WET GAS-METERS
IN CAST-IRON CASES,
THE UNVARYING WATER-LINE GAS-METER,
AND
IMPROVED DRY GAS-METERS;
STATION-METERS OF ALL SIZES, with PLANED JOINTS;
GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.
And all kinds of Experimental Gas Apparatus.

WILLEY & COMPANY,
GAS ENGINEERS,
WORKS: COMMERCIAL ROAD, EXETER,
INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF
EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.
NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.
RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.
They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.
An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.
PATTERN-BOOKS and PRICE LISTS furnished.
☞ PLEASE NOTE THE ADDRESS—
GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

JOHN ABBOT & CO., LIMITED,

MANUFACTURERS OF

IMPROVED

HYDRAULIC CRANES & HOISTS,

Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.

HYDRAULIC RAMS FOR LIFTING AND LOWERING PURIFIER COVERS.

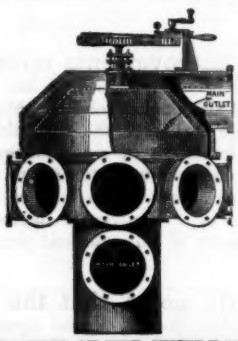
GAS PLANT GENERALLY, PIPES, ROOFING, TANKS, &c.,

PARK WORKS, GATESHEAD.

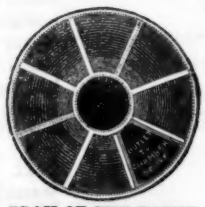
LONDON OFFICES: 2, SUFFOLK LANE, CANNON STREET, E.C.

GLASGOW OFFICES: 54, ST. ENOCH'S SQUARE.

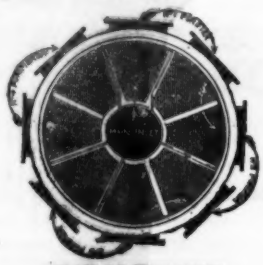
C. & W. WALKERS'
PATENT CENTRE-VALVES.



ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

THOMAS ALLAN & SONS,

IRONFOUNDERS,

WORKS:

SPRINGBANK FOUNDRY & NORTH WOODSIDE FOUNDRY,

GLASGOW;

BONLEA FOUNDRY, STOCKTON-ON-TEES,

Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.

„ 1½ to 10 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 15s. from Glasgow.

C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, re- quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

TO GAS COMPANIES AND THE TRADE.

J. DEFRIES & SONS,

MANUFACTURERS OF

CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS VESTIBULE LAMPS, AND THE PATENT CRYSTAL ILLUMINATION.

A LARGE STOCK ALWAYS IN HAND OF

IRON, BRASS, COMPOSITE, AND LEAD TUBES, FOR GAS AND WATER,

AND EVERY DESCRIPTION OF

GAS AND WATER FITTINGS.

THE PATENT DRY AND WET METER, WITH THE LATEST IMPROVEMENTS.

STREET LAMPS AND COLUMNS IN GREAT VARIETY.

WORKS: LONDON AND BIRMINGHAM.

GAS MOONS,
Cut and Engraved, of the newest designs

GAS REFLECTORS
In Silver and Glass

GAS NIBS
AND
BURNERS
Of every description.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1876, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.

ESTABLISHED 1830.

LESMAHAGOW CANNEL COAL.

FERRAND DAVIES,

148, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

SOLE AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

G. J. EVESON,

GAS COAL AND CANNEL FACTOR,

Has on offer, in quantities to suit purchasers, Best Wigan Arley Mine, Orrell Screened and Unscreened Gas Coal and Nuts; Best Yorkshire, Real Old Silkstone, Derbyshire, and North Staffordshire Screened and Unscreened Gas Coal and Nuts; also Best Lancashire, Yorkshire, Derbyshire, and other Cannel, as supplied to some of the principal Gas Companies in England, to whom references are permitted.

Analysis and Prices forwarded on application to HEAD OFFICES,

123, NEW STREET, BIRMINGHAM,

N.B.—Gas Managers will oblige by advising when they will be prepared to receive Tenders.

STOURBRIDGE FIRE-BRICKS, RETORTS, CLAY, &c.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

173, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

Established 1840.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or export Best Wigan Arley Gas Coal and Nuts; best qualities of the Derbyshire, Yorkshire, and North Staffordshire Gas Coals and Nuts; also the best descriptions of Lancashire, Welsh, Scotch, and other Cannel.

Messrs. WILSON CARTER & PEARSON, being contractors to several of the principal Gas Companies in the Midland Counties, have pleasure in being enabled to give them as references.

Chief Offices: Temple Buildings, 50, New Street, Birmingham.

London Offices: 6, Great Winchester St. Buildings, E.C.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,534 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9868 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

ADDISON POTTER,

WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of

CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD, LANCASHIRE.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

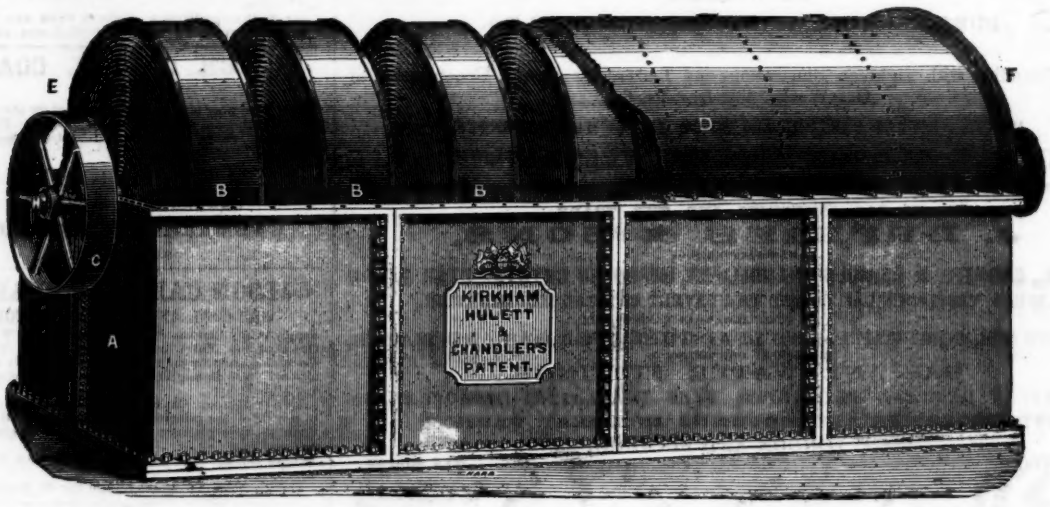
London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

July 2, 1877.

STANDARD WASHER AND SCRUBBER.



The advantages of the Apparatus will doubtless be understood by those interested in gas manufacture.

The principal points of any Apparatus for the extraction of ammonia may be summarily stated as follows:—

1. **A large amount of Surface is desirable.**
2. **Such Surface should be always effectually Wetted.**
3. **The Surfaces or Scrubbing Material should cause no Pressure.**
4. **The Gas should meet various strength Liquors on its course.**
5. **However small the quantity of Water used, it ought to operate over the whole Surface.**
6. **Changing Scrubbing Material is both Objectionable and Expensive.**
7. **Economy both as to Space occupied and Cost of Apparatus is an important item.**

All these requisitions are supplied by the above Apparatus, of which the following is an explanation:—

A is a cast-iron tank, formed into several separate water-tight compartments.

B B B volutes of sheet iron fitted to the centre shaft, which is driven by the pulley, C, and causing the said volutes to revolve each in a separate compartment filled with water or other fluid.

D, the cover, has partitions fitted into it corresponding with those in the tank, sufficient space being left between the top of the partition in the tank and the lower edge of that in the cover, to allow the gas a free passage through the first volute to the second, and so on to the third, fourth, &c.

The action is as follows:—The crude gas entering at E is partly washed in the first compartment, which becomes 10 or 12 oz. liquor, or stronger if required, according to the quantity allowed to enter per ton; the gas then passes to the second, where the liquor is of a less strength; thence into a weaker liquor, as it passes from one compartment to the other, finishing at the last compartment or outlet, F, with clean water, which is constantly flowing and running over from one compartment to another, until it reaches the last space, from which it flows from the outlet-pipe into the well or tank ready for sale or removal.

Taps are inserted in each compartment for the convenience of drawing liquor for testing, &c.

Applications as to Cost, &c., may be obtained of either

Mr. D. HULETT, 55 & 56, HIGH HOLBORN;

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER;

Or Messrs. CHANDLER, 104, NEWINGTON CAUSEWAY.

Inquirers will please state their Maximum Day Make.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

EDWARD COCKEY & SONS,

GAS ENGINEERS, FROME SELWOOD,

MANUFACTURERS OF ALL DESCRIPTIONS OF

APPARATUS CONNECTED WITH GAS-WORKS.

THE ORIGINAL PATENTEES AND MANUFACTURERS OF THE

DRY-FACED VALVES

FOR PURIFIERS, GASHOLDERS, BYE-PASS, AND OTHER ARRANGEMENTS REQUIRING VALVES IN GAS-WORKS.

The Faced Valves, as made by the Patentees, continue to give great satisfaction, and they are being used extensively by many of the best gas engineers of the day.

They are more easily repaired than any other kind of Valve in use, and can be re-ground in a few hours without removal, and made perfectly gas-tight.

References can be given to many Engineers of high standing, who will testify as to the favour in which they are held.

MANUFACTURERS ALSO OF SUPERIOR WOOD GRIDS FOR PURIFIERS, SCRUBBERS, &c.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

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Offices, Mersey Street, Warrington, April 23, 1877.

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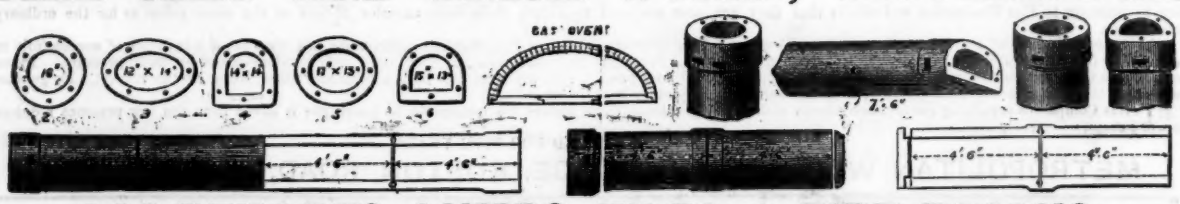

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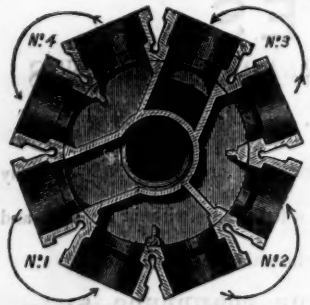

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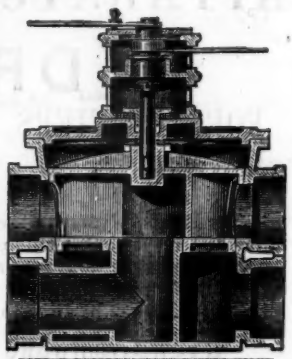

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